UPDATED TAXONOMY OF *GAERTNERA* (RUBIACEAE, GAERTNEREAE) IN MADAGASCAR, WITH SIXTEEN NEW SPECIES

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ABSTRACT

Gaertnera Lam. (Rubiaceae, Gaertnereae) includes 42 species confirmed from Madagascar, with 16 of them newly described here as a result of recent botanical exploration. The Madagascar species of *Gaertnera* have notable morphological variation. Newly described, illustrated, and keyed here are *G. arenarioides* C. M. Taylor, *G. breviflora* C. M. Taylor, *G. hirsuta* C. M. Taylor, *G. laevis* C. M. Taylor, *G. littoralis* C. M. Taylor, *G. malcomberiana* C. M. Taylor, *G. masoalana* C. M. Taylor, *G. nitida* C. M. Taylor, *G. rakotovaoana* C. M. Taylor, *G. razakamalalana* C. M. Taylor, *G. robusta* C. M. Taylor, *G. rubra* C. M. Taylor, *G. sclerophylla* C. M. Taylor, *G. velutina* C. M. Taylor, *G. vernicosa* C. M. Taylor, and *G. xerophila* C. M. Taylor. Narrower circumscriptions of *G. obovata* Baker var. *sphaerocarpa* (Baker) Malcomber and *G. phanerophlebia* Baker here are detailed by revised descriptions. Assessments of conservation status of *Gaertnera* in Madagascar using IUCN categories find two species Critically Endangered, 10 Endangered, 14 Vulnerable, two Near Threatened, and 14 species and two varieties of Least Concern.

Key words: *Gaertnera*, Gaertnereae, IUCN Red List, Madagascar, Rubiaceae.

Gaertnera Lam. (Rubiaceae, Gaertnereae) comprises shrubs and small trees found in tropical Africa, Madagascar, the Mascarene Islands, Sri Lanka, and Southeast Asia. The recent revision of *Gaertnera* (Malcomber & Taylor, 2009) recognized 69 species with four varieties plus one putative hybrid. *Gaertnera* can be recognized by its woody habit; opposite or ternate leaves; stipules that are united around the stem into a tubular structure and usually also fused to ridges or wings that encircle the petioles; cymose, bracteate inflorescences with the flowers solitary to numerous in variously a terminal, axillary, and/or pseudoaxillary position; generally cupuliform calyx limbs; salverform to funnelform corollas with four or five valvate lobes; ovaries that are superior in flower; and fleshy drupaceous fruits with usually two, rather thin-walled pyrenes. The secondarily superior position of the ovary is unusual in the Rubiaceae (Robbrecht, 1988), and has caused some confusion about the relationships of this genus. *Gaertnera* is also notable for its varied morphology and reproductive biology. This genus includes both distylous and dioecious species, with all plants of a geographic region apparently similar in breeding system: the species of Africa, Madagascar, the Mascarenes, and Sri Lanka are all distylous while the dioecious species are all found in Southeast Asia (Malcomber, 2002; Macomber & Taylor, 2009). *Gaertnera* presents several unusual morphological features, such as enlarged stipules and flexuous pendulous branches. Several of these unusual characters have been derived in parallel in geographically distinct, relatively rapid species radiations (Malcomber, 2002).

The recent revision of *Gaertnera* (Malcomber & Taylor, 2009) differed from the classifications of previous authors in several aspects, including the postulation of interspecific hybridization and narrower species circumscriptions. In particular Beusekom (1967) treated *G. vaginans* (DC.) Merr. as a widely distributed and morphologically variable species found throughout the range of the genus, with both distylous and dioecious plants, variously sessile and capitate to pedunculate and laxly cymose inflorescences, truncate to deeply lobed calyx limbs, and small to large corolla tubes (2.5–16 mm). In contrast, based on data from both morphology and molecular sequences Malcomber (2000) and Malcomber and Taylor (2009) classified the plants of Beusekom's *G.*

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vaginans in 12 distinct species, each of which is restricted to a single geographic region, has a consistent breeding system, and is less variable morphologically. Sufficient evidence was not found to support the separation of infrageneric taxa. This comprehensive revision of the genus provides a basis for further study, and here we present an updated review of *Gaertnera* in Madagascar. Botanical exploration has newly documented extensive areas in the last decade, discovering additional species and character states in the genus.

GAERTNERA IN MADAGASCAR

Gaertnera comprises 42 species confirmed to be present in Madagascar, all endemic, including the 16 species newly described here. This is a significant increase from the 29 species reported by Malcomber and Taylor (2009), with three of the species reported there based on historical collections with dubious collection localities. These three species, *G. calycina* Bojer, *G. crassiflora* Bojer, and *G. pendula* Bojer, are not included here. The three are all reliably documented from Mauritius, although *G. calycina* and *G. crassiflora* are now considered extinct.

Floristic study of Madagascar has demonstrated recently that Rubiaceae is the second most species-rich family on this island (Davis & Bridson, 2003; Callmander et al., 2011) after Orchidaceae. Among the Rubiaceae here, *Gaertnera* is one of the largest genera (Davis & Bridson, 2003). The drivers of this Rubiaceae diversity are as yet unknown, but molecular analyses estimated *Gaertnera*'s diversification to be relatively recent in geological terms, within the last 5–5.5 million years ago (mya) (Malcomber, 2002).

Following the vegetation classification of Moat and Smith (2007), most of the species of *Gaertnera* in Madagascar are found in humid forest. This genus is also rather well represented in littoral forest, and *G. nitida* C. M. Taylor ranges into dry forest. [The humid forest category of Moat and Smith corresponds to the combined categories "humid forest (low elevation)," "humid forest (mid altitude)," and "humid forest (lower montane)" of Du Puy and Moat (2003). The littoral forest category of Moat and Smith corresponds to the category "eastern coastal forest" of Du Puy and Moat. The dry forest cateogory of Du Puy and Moat corresponds to the category "seasonally dry forest" of Du Puy and Moat.]

Molecular phylogenetic analysis of *Gaertnera* species spanning the entire geographical range of the genus (Malcomber, 2002; Malcomber & Taylor, 2009) hypothesized that the species in Madagascar belong to two separate lineages: (1) *G. lowryi* Malcomber is hypothesized as sister to a clade of Sri Lankan and Southeast Asian species, albeit with marginal support, and (2) a clade containing all the other sampled species of Madagascar is hypothesized a sister to a clade of Mascarene species. This analysis hypothesized either a single or at least two separate dispersal event(s) of *Gaertnera* from Africa to Madagascar, followed by subsequent independent dispersals of *Gaertnera* to the Mascarenes and the region of Sri Lanka and southeastern Asia. Despite the uncertainty on the origins of the Madagascan species of *Gaertnera*, several features are shared by all of them: a distylous breeding system; inflorescence position terminal on main stems or lateral branches; entire (i.e., non-fenestrate) corolla tubes; and fruits with two hemispherical, smooth pyrenes. Otherwise, the full range of variation documented in the genus is found among the *Gaertnera* species in Madagascar.

Malcomber and Taylor (2009) described in detail the stipule morphology of *Gaertnera*, which is distinctive for the genus and often diagnostic for individual species. In general, the stipules are fused around the stem into a well-developed tube or sheath that is subtruncate to triangular at the top and often has one to four lobes. At the base of the stipule, rounded to flattened ridges or wings extend down at each side to encircle the petioles. This stipule form is unique in the Rubiaceae; *Gaertnera*'s Neotropical sister genus *Pagamea* Aubl. has similar stipule sheaths but lacks the wings that encircle the petioles. These stipule wings are also lacking in a few *Gaertnera* species (e.g., *G. laevis* C. M. Taylor), but are well developed in the early-diverging species of the phylogeny presented in Malcomber and Taylor (2009). Two different characteristic stipule morphological forms are found in *Gaertnera* and both are represented in the species of Madagascar. Stipule form is important for identification of species. Tubular stipules have a sheath that is cylindrical and open at the top in bud, so the leaves push through without breaking the sheath; the sheath may then split tardily as the stems enlarge. Calyptrate stipules are fully fused to form a cap covering the bud, so the expanding young leaves have to split the stipule as they push through it. Stipule form is apparently characteristic for a species, although it may be difficult to discern from study of older stipules on lower nodes. Older stipules of both forms are often fragmented by the expanding stem and general deterioration.

Several of the new species described here include some specimens that were classified by Malcomber and Taylor (2009) in previously described species. The circumscription and description of those previously described species are not appreciably changed by removal of these specimens, except in two cases: *Gaertnera obovata* Baker var. *sphaerocarpa* (Baker) Malcomber and *G. phanerophlebia* Baker are more narrowly circumscribed here. Revised descriptions of both species are presented. In addition, the conservation status of the *Gaertnera* species and varieties in Madagascar is assessed here, as noted under each individual species and summarized in Table 1.

METHODS

The species concept used here is similar to that of Malcomber and Taylor (2009). The measurements are all taken from dried specimens. Morphological terminology here follows that of Malcomber and Taylor (2009), where explanation and illustrations can be found. Our basic morphological terminology follows that of Radford et al. (1974). Stipule morphology is important for identification of *Gaertnera* species, and readers are strongly advised to consult Malcomber and Taylor (2009) for stipule terminology before using the Key to Species presented here. The term "stipule form" refers to the two different stipule morphologies, tubular and calyptrate. The term subsessile here is generally equivalent to a length of 0.3–0.7 mm. The description "opposite" applied here to the leaves denotes an arrangement with two leaves borne at a stem node. The Key to Species below is intended primarily for identification of specimens, rather than as a natural key to the systematic characters of the species. Descriptions and full nomenclature of the previously described species were presented by Malcomber and Taylor (2009) and are not repeated here, except full nomenclature is given for the accepted names cited here and descriptions are presented for the two species with significantly revised circumscriptions. Inflorescence color has not often been noted by collectors, and is not described here due to lack of data. Distributional information presented here is organized first by province (aritany mizakatena), and within each province then by the region (faritra). This organization follows the format of the specimen records in the TROPICOS® database (<http://www.tropicos.org>), and is intended to facilitate retrieval of data there and comparison with older studies. The provinces and regions of Madagascar are detailed on Wikipedia (<http://en.wikipedia.org/wiki/Madagascar#Administrative_divisions>). Vegetation descriptions in the distribution summary of the individual species generally follow those of Moat and Smith (2007), but also incorporate information from collector data regarding local conditions.

The information published here is extensively supplemented by online resources that are continually updated. The TROPICOS® database includes detailed information on *Gaertnera* nomenclature, images of living plants and specimens including types and exemplar specimens, phenology and elevational distribution, and specimen data including distribution maps. The Catalogue of the Vascular Plants of Madagascar (<http://www.tropicos.org/Project/MADA>) includes genus and species pages with a focus on biogeography and floristics of this island and detailed distributional data for each species. The Madagascar Catalogue should be consulted online for distribution maps and data for all the species treated here. The TROPICOS® Rubiaceae Project (<http://www.tropicos.org/Name/40011554projectid=34>) presents genus and species pages for *Gaertnera* with a focus on revisionary information, including morphological descriptions, bibliographic references, keys, and supplemental notes. A vegetation map of Madagascar with information on individual formations is available in The CEPF Madagascar Vegetation Mapping Project (<http://www.vegmad.org/maps.html>).

Conservation status was analyzed by assessing the risk of extinction according to the IUCN Categories and Criteria (IUCN 2012; IUCN Standards and Petitions Working Group 2012), and the methodology of the Catalogue of the Vascular Plants of Madagascar (Callmander et al., 2007). This methodology utilizes primary occurrence data compiled from reliably identified herbarium specimens (i.e., specimens with provisonal determinations were not included) in conjunction with geographical information systems (GIS) software to determine the geographic range size parameters of extent of occurrence (EOO, calculated as the area of the minimum convex polygon containing all points of known, inferred or projected sites of occurrence) and area of occupancy (AOO, estimated on the basis of suitable habitat within the EOO by extrapolating from the minimum area of occupancy as calculated by superimposing a 3.16 × 3.16 km grid onto the primary occurrence points and summing the cumulative area of occupied cells). These area parameters are then compared against threshold values, with the number of locations then determined in the context of threats to the species at known sites of occurrence. The impact of potential threats on continuing and future population decline incorporates two assumptions: (1) ongoing habitat degradation and destruction will leave few significant areas of primary vegetation outside the protected area network; and (2) loss of primary vegetation within protected areas will be minimal. Although some unprotected areas may escape destruction, such as on steep or rugged terrain, it is considered highly unlikely that populations of long-lived plants will survive outside protected areas for subsequent generations, given Madagascar's high rate of deforestation.

TAXONOMY

Gaertnera Lam., Tabl. Encycl. 1: 379, t. 167. 1792, nom. cons. TYPE: *Gaertnera vaginata* Poir.

Gaertnera includes 85 species found from Africa through Madagascar to the Mascarenes, and in Sri Lanka and southeastern Asia. See Malcomber and Taylor (2009: 592, 594–595) for a formal genus description and synonymy. In Madagascar 42 species and two varieties are confirmed present (Table 1).

KEY TO *GAERTNERA* SPECIES AND VARIETIES IN MADAGASCAR

1. Stipules persistent as 4 spathulate to linear segments, these often overlapping due to shortened internodes; leaves small, 0.3–1.5 × 0.3–1.8 cm; flowers solitary or 2, sessile or subsessile.

2. Leaves elliptic; calyx lobes 0.5–2.5 mm long; corolla tube 2.5–3 mm long .... 10. *G. furcellata* (Baill. ex Vatke) Malcomber & A. P. Davis

2′. Leaves cuneiform to spathulate or obovate; calyx lobes 2.4–3 mm long; corolla tube 4–4.5 mm long .... 25. *G. microphylla* Capuron ex Malcomber & A. P. Davis

1′. Stipules variously caducous, deciduous, persistent, or fragmenting, in form spathiform to cylindrical or apparently intra- or interpetiolar, those of successive nodes overlapping to well separated along stem, but not splitting into 4 persistent segments; leaves 0.5–51 × 0.3–14 cm; flowers solitary to numerous, sessile to pedunculate and/or pedicellate.

3. Young stems and leaves (at least abaxially) hirsute, hispid, pilose, hirtellous, velutinous, and/or tomentulose with spreading trichomes, or strigose to apparently arachnoid-pubescent with appressed trichomes ≥ 1 mm long, or with pubescence forming extensive patches with individual trichomes not evident; flowers 15 or more.

4. Pubescence of underside of leaf (i.e., abaxial surface) appressed, variously strigose to strigillose and/or lanose or apparently arachnoid.

5. Leaves elliptic-oblong, 2–7 cm wide, abaxially with pubescence strigose and sometimes also strigillose, with individual trichomes mostly evident; peduncle 0–4 cm long; inflorescence rather laxly cymose .... 15. *G. ianthina* Malcomber

5′. Leaves obovate or oblanceolate, 4–8.8 cm wide, abaxially with pubescence lanose or apparently arachnoid at least on costa, with individual trichomes mostly not evident; peduncle 0–0.8 cm long; inflorescence congested cymose .... 23. *G. malcomberiana* C. M. Taylor

4′. Pubescence of underside of leaf spreading, variously hirtellous, tomentellous, velutinous, pilose, hispid, and/or hirsute.

6. Calyx limb lobed, with lobes narrowly lanceolate to elliptic or ovate, 5–13 mm long; leaves with 9 to 12 pairs of secondary veins .... 31. *G. phyllosepala* Baker

6′. Calyx limb truncate, denticulate, or lobed, with lobes narrowly triangular to linear, 0.1–14 mm long; leaves with 5 to 30 pairs of secondary veins.

7. Calyx lobes 1.5–6 mm long with at least some lobes > 3 mm long; bracteoles 3–9 mm long.

8. Leaves with 14 to 30 pairs of secondary veins, with the intersecondary and higher-order venation regularly evident; inflorescences congested to rather laxly cymose, with secondary axes developed .... 12. *G. hirsuta* C. M. Taylor

8′. Leaves with 6 to 14 pairs of secondary veins, with the intersecondary and higher-order venation mostly not visible; inflorescences subcapitate, with secondary axes not or hardly developed .... 30. *G. phanerophlebia*

7′. Calyx limb truncate or lobed, with lobes ≤ 3 mm long; bracteoles 0.5–7 mm long.

9. Plants drying with orange or brownish orange color; stipule tubes 22–68 mm long; corolla tube 10–13 mm long .... 38. *G. schatzii* Malcomber

9′. Plants drying with green, grayish green, brownish green, brown, reddish brown, chestnut brown, or orangish brown; stipule tubes 6–35 mm long; corolla tube 4–11 mm long.

10. Stems hispid with spreading long trichomes .... 13. *G. hispida* Aug. D.C.

10′. Stems tomentellous, pilosulous, or hirtellous with spreading but rather short trichomes.

11. Calyx limb lobed, with lobes 1.5–3 mm long ...... 40. *G. velutina* C. M. Taylor

11′. Calyx limb subtruncate to shallowly lobed, with lobes ≤ 1 mm long and at least some shorter than this.

12. Leaves obovate or oblanceolate; bracteoles 1–2 mm long; flowers all sessile or mixed sessile and pedicellate, with pedicels 0.5–2 mm long; anthers 1.8–2.2 mm long .... 28b. *G. obovata* var. *sphaerocarpa*

12′. Leaves elliptic-oblong; bracteoles 2–5 mm long; flowers mixed sessile and pedicellate, with pedicels 2–5 mm long; anthers 2–3 mm long .... 33. *G. rakotovaoana* C. M. Taylor

3′. Young stems and leaves glabrous or puberulous to strigillose or hirtellous, with the pubescence not evident or patchy to sparse with individual trichomes separated or restricted to the principal veins, and flowers 1 to numerous; or, stems pilosulous to strigose, hirtellous, or villosulous, leaves puberulous to glabrous abaxially, and flowers 1 to 5.

13. Flowers solitary or 2 to 5, with inflorescences fasciculate to shortly cymose; leaves 0.5–7 × 0.3–4.2 cm.

14. Youngest internodes longitudinally ridged; leaves 0.5–3.8 × 0.3–2 cm.

15. Flowers borne on pedicels or peduncles 2.5–19 mm long; corolla tube 4–7.5 mm long.

16. Calyx lobes 0.4–4 mm long; stems often 2-winged and with corky bark .... 1. *G. alata* Bremek. ex Malcomber & A. P. Davis

16′. Calyx limb truncate or with lobes ≤ 0.4 mm long; stems with rounded corners, not becoming corky .... 29. *G. pauciflora* Malcomber & A. P. Davis

15′. Flowers sessile or subsessile, with pedicel or peduncle to 1 mm long; corolla tube 2.5–5.5 mm long.

17. Stipules caducous; leaves 0.4–2 cm wide; calyx lobes 1.1–4.2 mm long .... 6. *G. brevipedicellata* Malcomber & A. P. Davis

17′. Stipules persistent or tardily falling via fragmentation; leaves 0.3–0.5 cm wide; calyx lobes 0.5–2.5 mm long .... 10. *G. furcellata*

14′. Youngest internodes smooth; leaves 0.5–7 × 0.3–3.2 cm.

18. Calyx limb truncate or with lobes to 0.4 mm long; stems glabrous.

19. Stipules tubular; inflorescences sessile or with peduncles 9–30 mm long .... 4. *G. bambusifolia* Malcomber & A. P. Davis

19′. Stipules calyptrate; inflorescences with peduncles 2.5–9.1 mm long .... 29. *G. pauciflora*

18′. Calyx limb with lobes 0.4–4 mm long; stems glabrous, pilosulous, strigillose, or villosulous.

20. Stems glabrous; leaves 4–6.5 cm long .... 8. *G. darcyana* Malcomber & A. P. Davis

20′. Stems strigillose, pilosulous, or villosulous; leaves 0.5–4 cm long .... 22. *G. madagascariensis* (Hook. f.) Malcomber & A. P. Davis

13′. Flowers several to numerous (6 to 150), with inflorescences subcapitate, congested cymose, laxly cymose, or paniculiform; leaves 3–51 × 1.5–15 cm.

21. Calyx lobed with lobes 0.5–15 mm long, with at least several lobes on most flowers > 1.5 mm long.

22. Calyx lobes regularly to irregularly developed with the largest lobes 5–15 mm long, with at least some lobes narrowly lanceolate, elliptic, elliptic-oblong, or ovate (i.e., narrowed at the base), flowers mostly or all subtended by bracteoles 5–16 mm long, these often white and petaloid.

23. Stipules tubular; bracteoles 5–10 mm long; calyx lobes 5–13 mm long ... 31. *G. phyllosepala*

23′. Stipules calyptrate; bracteoles 8–16 mm long; calyx lobes 6–15 mm long .... 32. *G. phyllostachya* Baker

22′. Calyx lobes regularly to irregularly developed with the largest lobes 1.5–7 mm long, narrowly to broadly triangular, ligulate, or linear (i.e., mostly not narrowed at base); flowers subtended by bracteoles 0.5–9 mm long, these green to white, generally not petaloid.

24. Flowers 2 to 9 in lax fascicles or cymes; inflorescences with branched portion 0.8–2 × 0.4–2.5 cm .... 8. *G. darcyana*

24′. Flowers 10 or more in congested to lax cymes; inflorescences with branched portion 1–19 × 1–20 cm.

25. Inflorescences subcapitate or congested cymose, subsessile, subglobose, with secondary axes not or hardly developed; stipules calyptrate ... 30. *G. phanerophlebia*

25′. Inflorescences cymose, branched in 2 to 5 orders, pedunculate or sometimes sessile and apparently 3-partite, corymbiform to pyramidal, with secondary axes developed; stipules calyptrate or tubular.

26. Stipules calyptrate, drying membranceous or papery.

27. Calyx with lobes 3 to 5, ligulate, 1.5–5 mm long in flower (unknown in fruit); corolla tube 3.5–5 mm long; plants drying orangish brown or brown .... 24. *G. masoalana* C. M. Taylor

27′. Calyx wth lobes 1 to 3, triangular to lanceolate or ligulate, 1–3 mm long in flower and up to 5 mm long in fruit; corolla tube 6.5–10 mm long; plants drying greenish brown .... 34. *G. raphaelii* Malcomber

26. Stipules tubular, drying papery to chartaceous.

28. Calyx lobes spathulate and well developed, at least some of them 3.5–7 mm long; leaf venation mostly not evident abaxially; stipules with tube 3–10 mm long .... 14. *G. humblotii* Drake

28′. Calyx lobes triangular to ovate, 0.5–3.5 mm long; leaves with secondary and sometimes higher-order venation evident abaxially; stipules with tube 6–33 mm long.

29. Stipules with tube inflated or funnelform, 10–33 mm long, usually covering most or all of the internode above, at top irregular to broadly 4-lobed, with margins thinly marcescent; petioles 18–20 mm long .... 21. *G. macrostipula* Baker

29′. Stipules with tube cylindrical, 6–16 mm long, covering half or less of the internode above, at top subtruncate and with 4 distinct lobes, with margins not marcescent; petioles 4–15 mm long.

30. Leaves matte on both surfaces; corolla lobes abaxially smooth or only a little thickened .... 40. *G. velutina*

30′. Leaves often shiny on both surfaces; corolla lobes with well-developed abaxial thickenings or horns .... 41. *G. vernicosa* C. M. Taylor

21′. Calyx truncate or with lobes up to 1.2 mm long, or occasionally with 1 or 2 lobes on a few flowers up to 2 mm long but in this case at least some of the others < 1.2 mm long.

31. Stipules calyptrate.

32. Bracts 4–50 mm long, lanceolate, elliptic, ligulate, or ovate (i.e., generally narrowed at base); bracteoles 1–16 mm long with at least some of them > 5 mm long.

33. Petioles without stipular wings; bracteoles 1–5 mm long .... 17. *G. laevis*

33′. Petioles encircled by stipular wings; bracteoles 8–16 mm long .... 32. *G. phyllostachya*

32′. Bracts 0.8–27 mm long, triangular, ligulate, deltate, lanceolate, narrowly elliptic, or linear (i.e., usually not narrowed at base); bracteoles 0.5–5 mm long.

34. Leaves drying chartaceous to coriaceous, with secondary veins plane to prominulous below or sometimes not evident, with remaining venation plane.

35. Leaves drying subcoriaceous to coriaceous, with secondary veins not visible abaxially; calyx with tube 1.5–2.2 mm long and lobed, with lobes 0.2–1.2 mm long; corolla tube ca. 2.5 mm long .... 42. *G. xerophila* C. M. Taylor

35′. Leaves drying chartaceous to subcoriaceous, with secondary veins at least weakly visible abaxially; calyx with tube 0.8–1.5 mm long and truncate or lobed, with lobes ≤ 0.4 mm long; corolla tube 3–6 mm long.

36. Leaves elliptic, elliptic-oblong, or oblanceolate, 1.7–13.2 × 0.7–4.6 cm, at base gradually narrowed then cuneate to obtuse; stipules generally caducous; drupes 4.5–5.5 mm in diameter .... 11. *G. guillotii* Hochr.

36′. Leaves obovate, oblanceolate, or oblong-obovate, 6.5–26 × 3–11 cm, at base somewhat narrowed then rather abruptly obtuse to rounded; stipules deciduous or with basal portion persistent; drupes 7–10 mm in diameter .... 39. *G. sclerophylla* C. M. Taylor

34′. Leaves drying papery to subcoriaceous, with secondary venation prominulous to prominent below and generally evident, with remaining venation evident or not.

37. Calyx with tube 2–3 mm long and on at least some flowers > 2 mm long; corolla with tube 9–12 mm long.

38. Corolla white; inflorescences with peduncle 9–14 cm long and branched portion 12–22 × 6–22 cm; branchlets 3.5–6 mm diam.; petioles 7–12 mm long; Antsiranana .... 3. *G. arenarioides* C. M. Taylor

38′. Corolla white, red, pink, orange, or violet; inflorescences sessile or with peduncle to 10.5 cm long and branched portion 3.5–10 × 5–14 cm; branchlets 5–10 mm diam.; petioles 10–40 mm long; Toamasina .... 37. *G. rubra* C. M. Taylor

37′. Calyx with tube 0.8–2 mm long and on at least some flowers < 2 mm long; corolla with tube 4–9 mm long.

39. Bracteoles generally small, 1–2 mm long .... 28. *G. obovata* Baker

40. Leaves elliptic, elliptic-oblong, oblanceolate, obovate, or ovate, 1.2–8.5 × 0.7–5.2 cm; long-styled flowers with anthers included; drupes 4–5 × 5–6 mm ...... 28a. *G. obovata* var. *obovata* (Baker) Malcomber

40′. Leaves obovate or oblanceolate, 6–23.5 × 1.8–9 cm; long-styled flowers with anthers exserted; drupes 6–7 × 6–7 mm .... 28b. *G. obovata* var. *sphaerocarpa*

39′. Bracteoles small to well developed, 1–5 mm long, with at least some > 3 mm long.

41. Pedicels 0.5–2 mm long; petioles 5–25 mm long; corolla with tube ca. 1.5 mm diam. and lobes ca. 2 mm long; 0–450 m elevation .... 17. *G. laevis*

41′. Pedicels 2–5 mm long; petioles 3–11 mm long; corolla with tube ca. 1.2 mm diam. and lobes 3.5–4 mm long; 738–1489 m elevation .... 33. *G. rakotovaoana*

31′. Stipules tubular.

42. Inflorescences subcapitate, spiciform, or narrowly pyramidal, without tertiary axes, with secondary axes undeveloped or developed, 2–15 mm long, and terminating in a 3- to 5-flowered cyme.

43. Inflorescences subcapitate, with axes hardly developed; stipules with 1 deep incision; corolla lobes 5 .... 9. *G. drakeana* Aug. D.C.

43′. Inflorescences spiciform to narrowly pyramidal, with primary axis at least shortly developed; stipules without incisions or with 2 short incisions; corolla lobes 4.

44. Inflorescences pendulous on flexuous peduncles, these often produced on supra-axillary branches; stipules lobes 0.5–11 mm long .... 16. *G. inflexa* Boivin ex Baill.

44′. Inflorescences erect to pendulous on straight or geniculate peduncles, these terminal on principal branches; stipule lobes 0.3–3 mm long.

45. Leaves elliptic-lanceolate, elliptic-oblong, elliptic, or obovate, most or all leaves widest at or below middle; corolla with tube 5–6 mm long, lobes 3.5–5 mm long .... 7. *G. cardiocarpa* Boivin ex Baill.

45′. Leaves oblanceolate to narrowly oblanceolate, most or all leaves widest above middle; corolla with tube ca. 3.5 mm long, lobes ca. 2 mm long .... 18. *G. littoralis* C. M. Taylor

42′. Inflorescences paniculiform, thyrsiform, corymbiform-rounded, or pyramidal, with secondary axes developed, 12–75 mm long, and terminating in a 5- to 7-flowered cyme and/or bearing tertiary axes.

46. Stipules with tubes 35–51 mm long, persistent, generally overlapping at consecutive nodes, with 2 interpetiolar incisions that create 2 intrapetiolar segments, the segments 15–50 mm long, acute to truncate .... 26. *G. monstruosa* Malcomber

46′. Stipules with tubes 2–80 mm long, persistent or deciduous, overlapping or not at consecutive nodes, remaining entire and truncate to acute or with 1 or 2 incisions, sometimes with the 2 incisions creating 2 interpetiolar or intrapetiolar segments 10–18 mm long and acute to obtuse.

47. Leaves narrowly elliptic to oblanceolate, 29–40 × 5.3–8.4 cm; stipules with tubes 29–80 mm long; inflorescences pendulous, with peduncle 5–16 cm long; corolla with tube 18–21 mm long .... 19. *G. lowryi*

47′. Leaves elliptic, narrowly elliptic, elliptic-oblong, oblanceolate, or obovate, 5.5–28 × 2–15 cm; stipules with tubes 5–25 mm long; inflorescences erect to strongly deflexed, subsessile to pedunculate with peduncle to 15 cm long; corolla with tube 2–16 mm long.

48. Corolla with tube 10–16 mm long and lobes 3.5–5.5 mm long .... 2. *G. arenaria* Baker

48′. Corolla with tube 2–10 mm long and lobes 2–3 mm long.

49. Corolla tube 6–10 mm long and on at least some flowers longer than 6 mm; leaves 6–15 cm wide; calyx limb with tubular (i.e., unlobed) portion 1–2.5 mm long.

50. Calyx with tubular portion 1–1.5 mm long, truncate or lobed with lobes to 0.3 mm long; corolla tube 6.5–10 mm long; fruit 8–9 × 8–10 mm .... 20. *G. macrobotrys* Baker

50′. Calyx with tubular portion 1.8–2.5 mm long, lobed with lobes 0.8–1.1 mm long; corolla tube 6–8 mm long; fruit 5–6 × 6–8 mm .... 36. *G. robusta* C. M. Taylor

49′. Corolla tube 2–6 mm long; leaves 3.5–11 cm wide; calyx limb with tubular (i.e., unlobed) portion 1–3 mm long.

51. Calyx with tubular portion 1.8–3 mm long; leaves with 4 to 6 pairs of secondary veins and the tertiary venation finely reticulated and visible abaxially .... 27. *G. nitida*

51′. Calyx with tubular portion 1–1.5 mm long; leaves with 5 to 9 pairs of secondary veins and the tertiary venation not visible or loosely reticulated and sparsely or only weakly visible abaxially.

52. Leaves at apex rounded to truncate, without acuminate tips or with tips 1–1.5 mm long; stipule tubes inflated; inflorescences with peduncle 2–5 cm long and branched portion 11–19 cm long .... 35. *G. razakamalalana* C. M. Taylor

52′. Leaves at apex obtuse or acuminate with tips 3–10 mm long; stipule tubes loose around stem but not much inflated; inflorescences with peduncle 3–8.5 cm long and branched portion 5.5–14 cm long.

53. Corolla tubes 2–3 mm long; stipules with tubular portion 5–16 mm long .... 5. *G. breviflora* C. M. Taylor

53′. Corolla tubes 4–6 mm long; stipules with tubular portion 15–25 mm long............ 29. *G. sclerophylla* (Note: This species has calyptrate stipules but sometimes these can be easily confused with tubular stipules, therefore this species is keyed here under both conditions)

1. **Gaertnera alata** Bremek. ex Malcomber & A. P. Davis, Monogr. Syst. Bot. Missouri Bot. Gard. 104: 379, fig. 2. 2005. TYPE: Madagascar. Toamasina: Atsinanana, forêt d'Andasibe, bassin de l'Onive, Feb. 1925, *H. Perrier de la Bathie 17098* (holotype, P).

Distribution and IUCN Red List category. *Gaertnera alata* is known only from the type collection made in 1925 and two other collections made in 1999, all from the Ankilahila forest southeast of Tsinjoarivo along the border of the provinces of Toamasina and Antananarivo in central eastern Madagascar at 1400–1550 m. The type collection cannot be precisely georeferenced, but is probably in the same general vicinity as the more recent collections. Lacking any formal protection, this area of escarpment subhumid forest is subject to ongoing clearing, and therefore the species is likely to experience decline at its single known location. Thus, *G. alata* is here considered Critically Endangered (CR) due to its limited geographic range (AOO = 10 km^2) and threats to its habitat [B2ab(iii)].

See Malcomber and Taylor (2009: 600) for a species description.

2. **Gaertnera arenaria** Baker, J. Linn. Soc., Bot. 20: 209. 1883. *Sykesia arenaria* (Baker) Kuntze, Revis. Gen. Pl. 2: 425. 1891. TYPE: Madagascar. Toamasina: Atsinanana, Tranomaro near Tamatave, sands near sea, July 1862, *C. J. Meller s.n.* (holotype, K).

Distribution and IUCN Red List category. *Gaertnera arenaria* has a large geographic range (EOO = 222,903 km^2) in humid and subhumid forest from sea level to 1400 m elevation, from northern to eastern and southeastern Madagascar in the provinces of Antsiranana, Fianarantsoa, Toamasina, and Toliara. Additionally it is found in numerous protected areas (Andohahela, Lokobe, Mananara-Nord, Manongarivo, Marojejy, Masoala, Montagne d'Ambre, Nosy Mangabe, and Tsaratanana), thus *G. arenaria* is here considered to be of Least Concern (LC).

See Malcomber and Taylor (2009: 602–603) for a species description and synonymy.

3. **Gaertnera arenarioides** C. M. Taylor, sp. nov. TYPE: Madagascar. Antsiranana: DIANA, Ambanja, Ambodimanga-Ramena, Antsahabe, Mandrizavona village, 13°48″S, 48°45″E, 460 m, 12 Apr. 2000, *J. Rabenantoandro, D. Ravelonarivo, F. Ratovoson & R. Razafindramanana 167* (holotype, MO-5737702!; isotypes, P n. v., TAN n. v.). Figure 1.

Haec species a *Gaertnera arenaria* Baker stipulis calyptratis unilobis atque foliorum venatione tertiaria non vel interdum manifesta, a *G. obovata* Baker alabastris acutis, foliis apice acutis vel leniter acuminatis, stipulis unilobis ad nodos summos 3 persistentibus atque domatiis ex lineis hirtellis constantibus distinguitur.

Shrubs to 5 m tall, drying brown to dark brown; branchlets 3.5–6 mm diam., flattened to subquadrangular, glabrous. Leaves opposite; blades obovate, oblanceolate, or elliptic-oblong, 12–25 × 4–7.5 cm, drying chartaceous and matte, glabrous on both surfaces, at base cuneate to obtuse or rounded, at apex acute to weakly acuminate with tips 5–10 mm; secondary veins 6 to 10 pairs, abaxially prominulous to prominent, with domatia in form of irregular patches of hirtellous pubescence along midrib and sometimes basal portions of secondary veins, with remaining venation not visible or intersecondary veins sometimes visible; petioles 7–12 mm, glabrous; stipules calyptrate, glabrous, drying papery to chartaceous and brown, generally persistent, 25–35 mm, on each side with 2 ridges or wings, these 0.2–1 mm wide and widened from top to bottom, continuing as flattened wings ca. 0.5 mm wide encircling petioles, apex with 1 well-developed incision, with 1 lobe, narrowly triangular to linear, 2.5–3 mm. Inflorescence cymose, many-flowered (50+), terminal on principal branches, erect, glabrous, sessile or pedunculate; peduncles 9–14 cm; branched portion pyramidal to narrowly pyramidal, 12–21 × 6–22 cm, branched to 3 or 4 orders, often with secondary axes very well developed; bracts narrowly triangular to lanceolate or ovate, 3–12 mm, or those subtending secondary axes sometimes foliaceous; bracteoles ovate, 1–2.5 mm. Flowers sessile, biology unknown, 5-merous; calyx cupuliform, 2.5–3 mm wide, externally and internally glabrous, tube 2–3 mm, subtruncate to denticulate or dentate, teeth 5, broadly triangular, to 0.5 mm, subequal; corolla acute in bud, at anthesis salverform, white, externally glabrous, internally densely barbate in throat and on basal portions of lobes, tube 10–12 mm, cylindrical to weakly funnelform, ca. 2 mm diam. near middle, lobes narrowly ligulate, ca. 5 mm, at apex smooth abaxially and adaxially; anthers in presumed short-styled form 3.5–4 mm, partially exserted; stigmas not seen. Drupes subglobose, ca. 8 mm diam., violet or black; pyrenes 2, hemispherical, abaxially smooth.

Habitat, distribution, and phenology. *Gaertnera arenarioides* is known from humid forests at 460–700 m in the province of Antsiranana and the region of DIANA; it has been collected in flower in April and in fruit in March.

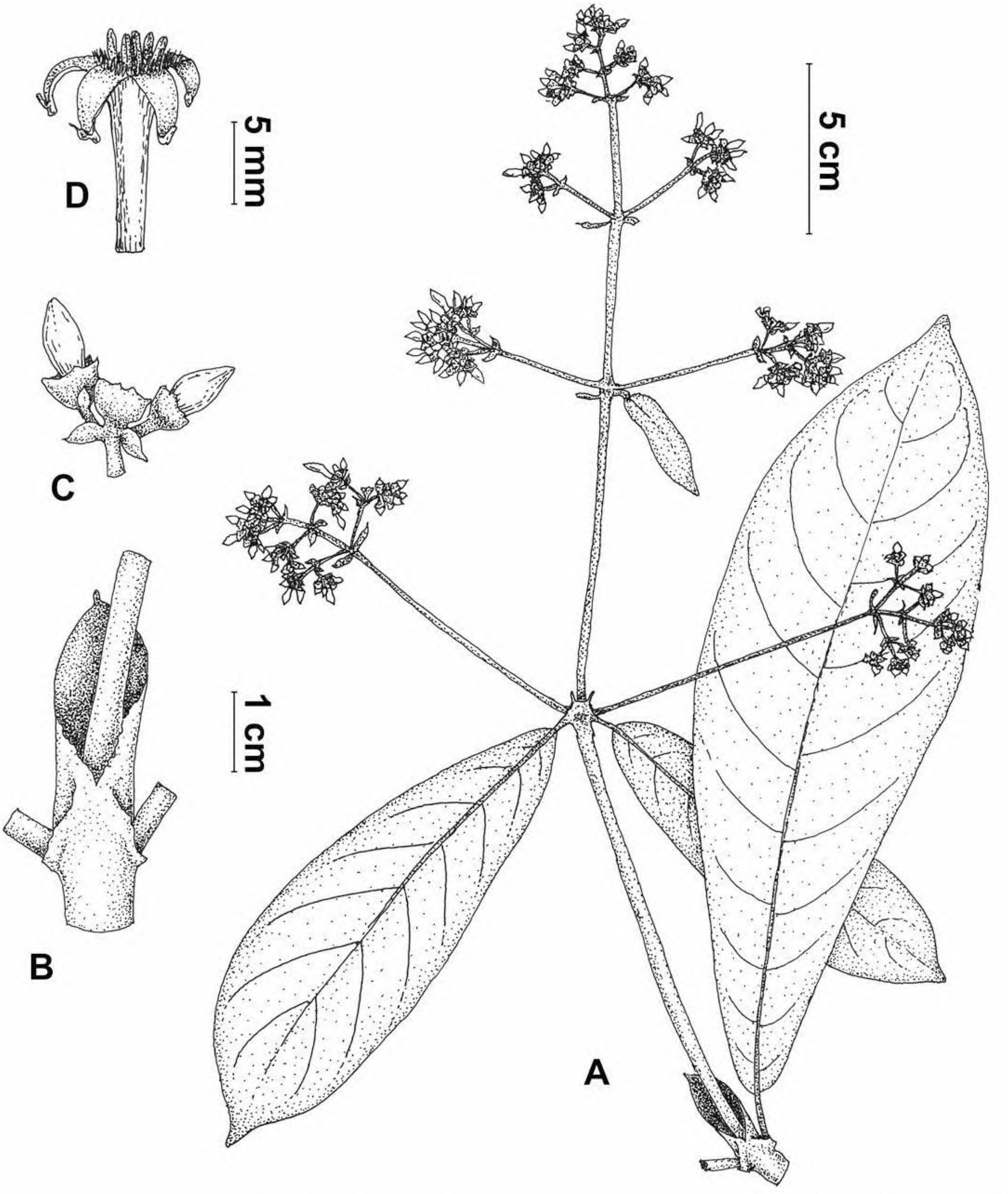

Figure 1. *Gaertnera arenarioides* C. M. Taylor. —A. Flowering branch. —B. Portion of stem, with node, stipule, and bases of two petioles. —C. Portion of inflorescence, with two flower buds and one flower from which corolla has fallen. —D. Corolla at anthesis, dissected off flower. C, D, to same 5-mm scale. Based on the type *J. Rabenantoandro et al. 167* (MO).

IUCN Red List category. *Gaertnera arenarioides* is known only from along the northern boundary of the Tsaratanana protected area, both within and outside of the protected area. The area outside of the protected area is subject to ongoing clearing and conversion for agriculture. Therefore, with a very limited geographic range (an EOO and AOO of only ca. 12 km^2), threats to its habitat outside of the protected area, and only 3 locations, *G. arenarioides* is here considered to be Endangered [EN B1ab(iii)-2ab(iii)].

Discussion. *Gaertnera arenarioides* is similar in general aspect and several features to *G. arenaria*, and has previously been confused with it; the species epithet refers to this similarity. *Gaertnera arenaria* is found widely in Madagscar, and differs from this new species in its cylindrical tubular stipules, leaves with the tertiary venation extensively reticulated and visible, and usually longer corollas with tubes 10–16 mm (for contrasting character states of *G. arenarioides*, see its description above). This new species is also similar to *G. obovata* var. *sphaerocarpa*, which is also found widely in Madagascar and differs in its foveolate domatia, generally corymbiform inflorescences with the axes pubescent, and caducous 2-lobed stipules.

Paratypes. MADAGASCAR. **Antsiranana:** DIANA, Antsahabe, Ambanja, Réserve Nat. Intégrale de Tsaratanana, Antsahafaly River, Mandrizavona village, 13°53′S, 48°49′E, *P. Antilahimena et al. [sic, no other collectors listed] 387* (MO, P, TAN), *P. Antilahimena et al. [sic, no other collectors listed] 405* (MO, P, TAN); Antsaharatsy, *J. Rabenantoandro, D. Ravelonarivo, F. Ratovoson & P. Antilahimena 188* (K, MO, P, TAN).

4. **Gaertnera bambusifolia** Malcomber & A. P. Davis, Monogr. Syst. Bot. Missouri Bot. Gard. 104: 380, fig. 2. 2005. TYPE: Madagascar. Antisiranana: SAVA, Rés. Nat. Marojejy, along trail to summit of Marojejy Est, NW of Mandena, 850–1000 m, *J. S. Miller & P. P. Lowry 3978* (holotype, MO; isotypes, K, P, TAN).

Distribution and IUCN Red List category. *Gaertnera bambusifolia* is known only from two collections in northeastern Madagascar, in the province of Antsiranana and the region of DIANA at 850–1235 m. The two known mid-elevation subpopulations in subhumid forest are encompassed within the Anjanaharibe-Sud and Marojejy protected areas, respectively, and are therefore currently not subject to threat (the recent illegal exploitation of rosewood having occurred at lower elevations than this within Marojejy). Therefore, with no population decline anticipated, the species is here considered to be of Least Concern (LC).

See Malcomber and Taylor (2009: 604–605) for a species description.

5. **Gaertnera breviflora** C. M. Taylor, sp. nov. TYPE: Madagascar. Toliara: Anosy, N Ft. Dauphin (Tôlañaro), near St. Luce (Manofiafy), just behind coastal dunes, S & W of fishing village, 24°47′S, 47°10′E, 25 m, 20 Oct. 1989, *G. McPherson, N. Dumetz & R. Rabevohitra 14192* (holotype, MO-3767834!; isotypes, K. n. v., TEF n. v.). Figure 2D–F.

Haec species a *Gaertnera obovata* Baker var. *sphaerocarpa* (Baker) Malcomber stipulis tubularibis plerumque persistentibus, a *G. macrostipula* Baker calyce subtruncato denticulatove, ab ambabus corolla breviore distinguitur.

Shrubs and small trees to 10 m tall, drying brownish green or brown; branchlets 3.5–7 mm diam., quadrangular, glabrous. Leaves opposite; blades obovate, oblanceolate, elliptic, or oblong-obovate, 8–20 × 3.5–10.5 cm, drying chartaceous to subcoriaceous and matte, glabrous on both surfaces, at base obtuse to infrequently rounded or acute, at apex acute to rounded and often with acuminate tips 3–10 mm; secondary veins 5 to 7 pairs, thinly prominulous abaxially, with narrow foveolate domatia ca. 0.1–0.2 mm deeply inserted in vein axils, with intersecondary and tertiary venation not or sparsely (i.e., few veins widely scattered) visible abaxially; petioles 3–22 mm, glabrous; stipules tubular, glabrous, drying papery to chartaceous and brown, generally persistent, tube 5–16 mm, smooth, with wing flattened to rounded, 0.3–1.2 mm, encircling petioles and extending to unite with base of tube, apex truncate or with 1 or 2 incisions, with 4 narrowly triangular to linear lobes 1–5 mm, ciliolate. Inflorescences lax to somewhat congested cymose, many-flowered (50+), terminal on principal branches, erect, moderately to densely pilosulous-puberulous, pedunculate; peduncle 3–8.5 cm; branched portion pyramidal to broadly pyramidal, 5.5–10 × 5–11 cm, branched to 3 or 4 orders; bracts narrowly triangular to narrowly ligulate, 3–10 mm, or those subtending secondary axes frequently foliaceous; bracteoles ligulate to triangular or frequently 3-lobed, 1–4.5 mm. Flowers sessile or subsessile, distylous, 5-merous; calyx cupuliform, 2–2.5 mm wide, externally glabrous to puberulous at least near base, internally glabrous except with a strigillose ring near middle inside, truncate to denticulate, tube 1–1.2 mm, teeth 5, triangular, to 0.3 mm or occasionally on some flowers of an inflorescence triangular to ligulate, 0.8–1 mm (e.g., *Rabenantoandro & Morja 1594*, *Decary 10135*); corolla obtuse to rounded in bud, at anthesis salverform, white or greenish white, externally glabrous, internally barbate in upper part of tube and onto lobes, tube 2–3 mm, cylindrical to funnelform, ca. 1.2 mm diam. near middle, lobes ligulate-triangular, 2–3 mm, at apex abaxially smooth, adaxially smooth or very shortly hooked; anthers in short-styled form ca. 1.5 mm, exserted, in long-styled form 1.1–1.5 mm, partially exserted; stigmas in short-styled form ca. 1 mm, included, positioned in upper part of corolla tube, in long-styled form 0.5–1 mm, exserted. Drupes ellipsoid to obovoid and laterally sometimes somewhat flattened, 6–9 × 6–9 mm, purple-black, blue-black, or blue; pyrenes 2, hemispherical, smooth abaxially.

Habitat, distribution, and phenology. *Gaertnera breviflora* is known from littoral forest and low-

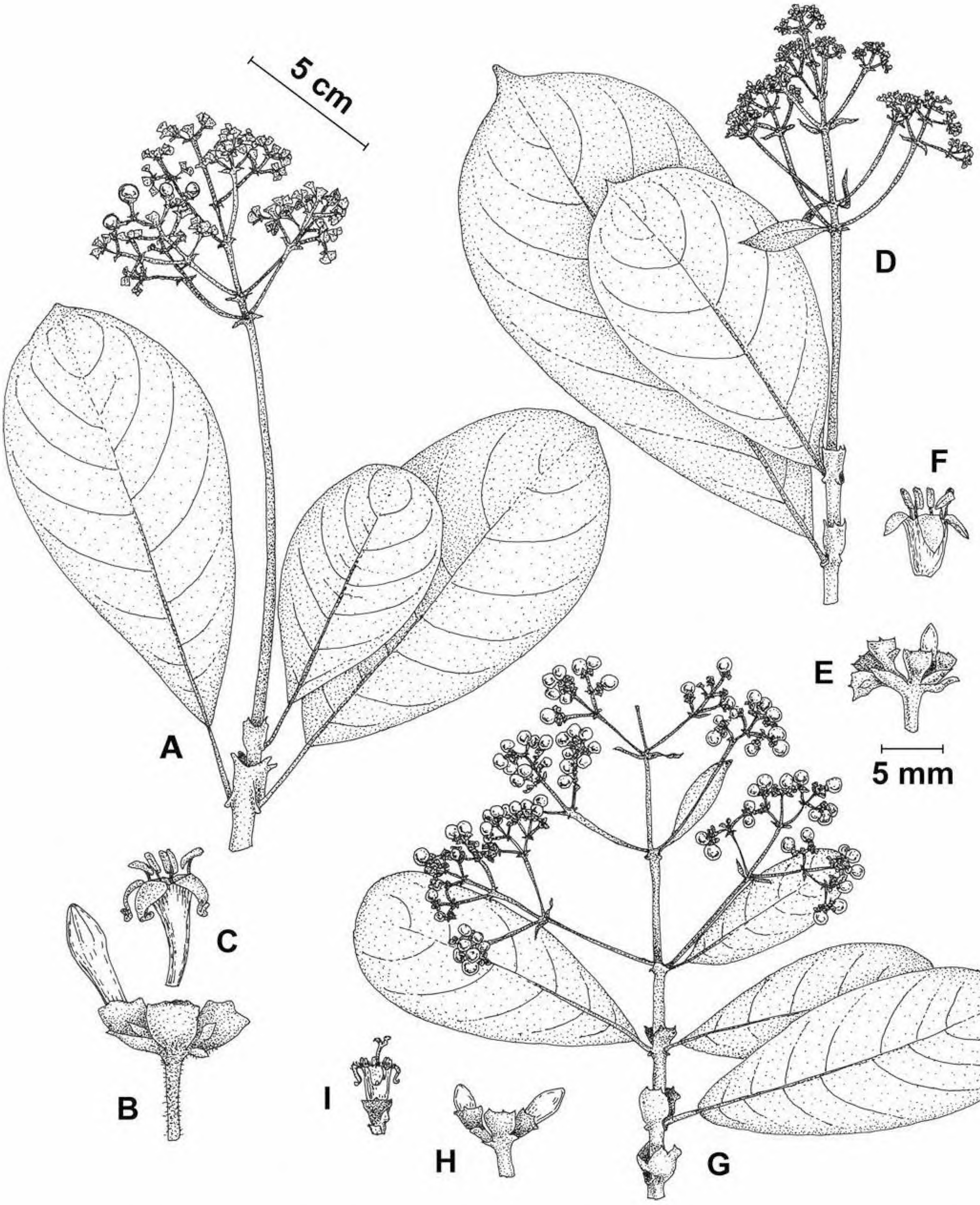

Figure 2. A–C. *Gaertnera robusta* C. M. Taylor. —A. Flowering branch, based on *M. Andrianarisata 102* (MO). —B. Portion of inflorescence, with one flower bud and two flowers from which corollas have fallen. —C. Corolla at anthesis, dissected off flower. B, C, based on the type *F. Ratovoson & F. Randiantafika 13* (MO). D–F. *Gaertnera breviflora* C. M. Taylor. —D. Flowering branch, based on *A. P. Davis et al. 1214* (MO). —E. Portion of inflorescence, with one flower bud and five flowers from which corollas have fallen. —F. Corolla at anthesis, dissected off flowers. E, F, based on the type *G. McPherson et al. 14192* (MO). G–I. *Gaertnera razakamalalana* C. M. Taylor. —G. Flowering branch, based on *Rabevohitra et al. 5011i* (MO). —H. Portion of inflorescence with two flower buds and one flower from which corolla has fallen. —I. Flower at anthesis. H–I, based on the type *G. E. Schatz et al. 3604* (MO). A, D, G, to same 5-cm scale; B, C, E, F, H, I, to same 5-mm scale.

elevation, evergreen humid forest on sand and laterite at 0–250 m in the province of Toliara and the region of Anosy and is often reported from swampy microsites. *Gaertnera breviflora* has been collected in flower in June, July, and October through December, and in fruit in January, February, October, and December.

IUCN Red List category. This species is found in the littoral forest fragments that have received protection in conjunction with ongoing mining activities (Mandena, Petriky, Sainte Luce), but the species is nevertheless experiencing decline in other non-protected forest fragments subject to exploitation for timber and firewood. The geographic range size currently meets the threshold for Endangered (EOO = 1083 km^2; AOO < 500 km^2), but with seven separate locations. *Gaertnera breviflora* is here considered instead to be Vulnerable [VU, B1ab(ii,iii,iv)+2ab(ii,iii,iv)]; however, it could soon become Endangered as locations or subpopulations are lost.

Discussion. *Gaertnera breviflora* can be recognized by its well-developed, tubular, usually persistent, smooth stipules; leaves with the secondary venation generally not at all evident; thyrsiform or paniculiform inflorescences; calyx limbs that are truncate to denticulate or occasionally with one relatively larger lobe; relatively short corollas; and distribution at low elevations in southeastern Madagascar. The specific epithet refers to the relatively short corollas.

Gaertnera breviflora has been confused with *G. obovata* var. *sphaerocarpa*, which is found widely in Madagascar; however, *G. obovata* var. *sphaerocarpa* can be recognized by its spathaceous and generally caducous stipules, leaves usually with the tertiary venation visible abaxially, longer corollas with tubes 4–8 mm, and distribution generally at higher elevations, 360–1876 m (for contrasting character states of *G. breviflora*, see its description above). *Gaertnera breviflora* has also been confused with *G. arenaria*, which is found widely in Madagascar including in coastal forests; however, *G. arenaria* can be recognized by its stipules with four longitudinal ribs that extend from the base of the sheath to connect with the lobes, flowers that are mostly separated from each other on pedicels (or elongated axes) 1–5 mm long, and longer corollas with tubes 10–16 mm long. *Gaertnera breviflora* is also similar to *G. robusta* and *G. razakamalalana*; see the discussion under each of these other species for their separation from *G. breviflora*. Also similar is *G. sclerophylla*, described below and found in eastern through southeastern Madagascar, but these species differ in their stipules: tubular and truncate with the tube 5–16 mm long and four short lobes in *G. breviflora* versus calyptrate and acute with the tube 15–25 mm long and one or two lobes in *G. sclerophylla*.

Paratypes. MADAGASCAR. **Toliara:** Anosy, environs of St. Jacques, 5.4 km NNW Taolañaro, 24°59′S, 46°58′E, *A. P. Davis, J. Andrianantiana & D. Gower 1214* (K, MO); 10 km N Fort-Dauphin (Tôlañaro), forêt de Mandena, 24°57′S, 47°00–02′E, *P. De Block, F. Rakotonasolo, T. Randriamboavonjy, S. Dessein & V. Leyman 732* (BR, MO), *L. J. Dorr, L. C. Barnett, A. Rakotozafy, M. R. Cheek & N. Razafimalala 3981* (K, MO), *F. R. Fosberg 52549* (MO), *F. R. Fosberg 52553* (K, MO), *S. T. Malcomber 1175* (K, MO), *J. L. Zarucchi, E. Rakotobe, S. G. Razafimandimbison & A. Pool 7590* (K, MO); Pointe Itaperina, Dt. du Fort-Dauphin, *R. Decary 10135* (MO, P); Vinanibe, Dt. de Fort-Dauphin, *R. Decary 10745* (K, MO, P); ca. 11 km WSW Fort-Dauphin (Tôlañaro), Mananbaro, forêt de Petriky, 25°05′S, 46°52′E, *N. Dumetz, G. McPherson & R. Rabevohitra 806* (K, MO), *N. Dumetz & G. McPherson 1115* (K, MO), *R. E. Gereau, R. Rabevohitra & N. Dumetz 3367* (K, MO); above airport at Fort-Dauphin (Tôlañaro), 25°01′E, 46°57′E, *R. E. Gereau & N. Dumetz 3236* (K, MO); région de l'Anosy, Bemangidy Forest, ca. 3 km W Antsotso, along RN 12a, 65 km N Fort-Dauphin (Tôlañaro), 24°35″S, 47°13″E, *P. P. Lowry II, J. Rabenantoandro, F. Randriatafka, E. Lowry, E. Ramisy & B. Mara 6675* (MO), *P. P. Lowry II, J. Rabenantoandro, F. Randriatafka, E. Lowry, E. Ramisy & B. Mara 6742* (MO); NW of Fort-Dauphin (Tôlañaro) near rd. to Andohahela Reserve, 24°46′S, 46°53′E, *G. McPherson 14454* (MO); Fort-Dauphin (Tôlañaro), Mahatalaky, forêt de Sainte-Luce, 24°46′S, 47°10′E, *J. Rabenantoandro & A. Monja 1594* (MO); Fort-Dauphin (Tôlañaro), Ampasy, Mandena-Ambavarano, forêt d'Ambavarano, 24°56′S, 47°03″E, *R. Rajoharison & G. Tsiatrefy 23* (MO).

6. **Gaertnera brevipedicellata** Malcomber & A. P. Davis, Monogr. Syst. Bot. Missouri Bot. Gard. 104: 382, fig. 3. 2005. TYPE: Madagascar. Fianarantsoa: Vatovavy-Fitovinany, Ranomafana Nat. Park, Talatekely, 800–900 m, 5 Nov. 1977, *S. T. Malcomber, A. Davis, D. Gower, J. Andriantiana & A. Kotozafy 2877* (holotype, MO; isotypes, BR, G, K, P, PRE, TEF, WAG).

Distribution and IUCN Red List category. *Gaertnera brevipedicellata* is found in southeastern Madagascar in the province of Fianarantsoa at 800–1000 m. Although it is currently known only from subhumid forest within the protected areas of Andringitra and Ranomafana, its projected occurrence within the intervening escarpment forest results in a geographic range size of EOO = ca. 2700 km^2 and AOO = ca. 1470 km^2. Because of expected decline due to habitat degradation and conversion in projected sites of occurrence outside of protected areas and only six locations known, *G. brevipedicellata* is here considered to be Vulnerable [VU B1ab(iii)+2ab(iii)].

See Malcomber and Taylor (2009: 606–607) for a species description.

7. **Gaertnera cardiocarpa** Boivin ex Baill., Adansonia 12: 238. 1879. TYPE: Madagascar. Toamasina: Analanjirofo, Sainte Marie, Tanambo, Apr. 1851, *L.-H. Boivin s.n.* (holotype, P; isotypes, G, P).

Distribution and IUCN Red List category. *Gaertnera cardiocarpa* is known from northeastern Madagascar in the province of Toamasina at 0–300 m. Although several subpopulations of this humid forest species are found in protected areas (Mananara-Nord, Masoala), subpopulations outside of protected areas are experiencing decline from continuing conversion of forest. With a restricted geographic range size (EOO = 1099 km^2; AOO < 500 km^2) and only four known locations, *G. cardiocarpa* is here considered to be Endangered [EN B1ab(ii,iii,iv)+2ab(ii,iii,iv)].

See Malcomber and Taylor (2009: 609) for a species description.

8. **Gaertnera darcyana** Malcomber & A. P. Davis, Monogr. Syst. Bot. Missouri Bot. Gard. 104: 384, fig. 2. 2005. TYPE: Madagascar. Toamasina: Alaotra-Mangoro, 11.9 km N of Andasibe, Mantadia Nat. Park, 930 m, 21 Nov. 1997, *S. T. Malcomber, A. Davis, D. Gower & J. Andriantiana 2921* (holotype, MO; isotypes, BR, K, P, TEF, WAG).

Distribution and IUCN Red List category. *Gaertnera darcyana* is known from north-central to south-central eastern Madagascar at 700–1400 m in the provinces of Toamasina and Fianarantsoa. It is currently known from only five collections, two of which are from protected areas (Betampona, Mantadia). This species is likely to experience decline from habitat conversion outside of protected areas, particularly at the Ambatovy nickel-mining site. Due to its restricted geographic range size (EOO = 19,150 km^2; AOO = 5400 km^2), *G. darcyana* is here considered to be Vulnerable [VU B1ab(iii)].

See Malcomber and Taylor (2009: 612) for a species description; the petiole length was incorrectly given there as mm, this measurement is in cm.

9. **Gaertnera drakeana** Aug. DC., Bull. Herb. Boissier, Sér. 2, 1: 586. 1901. TYPE: Madagascar. Toamasina: Analanjirofo, Maroa [Maroantsetra], 1897, *A. Mocquerys 273* (holotype, G).

Distribution and IUCN Red List category. *Gaertnera drakeana* is found in northeastern Madagascar in the province of Toamasina at 0–300 m. It is distributed in low-elevation humid forest from south of the Ambatovaky protected area to the Bay of Antongil and is also present in the Mananara-Nord and Masoala protected areas. With a restricted geographic range size (EOO = 4574 km^2; AOO < 500 km^2), expected continuing decline outside of protected areas, and only four known locations, *G. drakeana* is here considered to be Endangered [EN B1ab(ii,iii,iv)+2ab(ii,iii,iv)].

See Malcomber and Taylor (2009: 614–616) for a species description.

10. **Gaertnera furcellata** (Baill. ex Vatke) Malcomber & A. P. Davis, Monogr. Syst. Bot. Missouri Bot. Gard. 104: 386, fig. 2. 2005. *Psychotria furcellata* Baill. ex Vatke, Abh. Naturwiss. Vereine Bremen 9: 118. 1885. TYPE: Madagascar. s. loc., 24 Nov. 1877, *D. C. Rutenberg s.n.* (holotype, P).

Distribution and IUCN Red List category. *Gaertnera furcellata* is known from central eastern Madagascar in the former province of Toamasina at 900–1335 m. It is known only from two historical collections from the Zahamena protected area, and a recent collection from unprotected forest near Anjozorobe. With a restricted geographic range size (EOO = 727 km^2; AOO < 500 km^2), expected continuing decline outside of the protected area, and only two known locations, *G. furcellata* is here considered to be Endangered [EN B1ab(iii)+2ab(iii)].

See Malcomber and Taylor (2009: 618–619) for a species description and synonymy.

11. **Gaertnera guillotii** Hochr., Annuaire Conserv. Jard. Bot. Gèneve, 11–12: 115. 1908, non *Gaertnera guillotii* (Hochr.) Bremek., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Sect. 2. Amsterdam 54(5): 148. 1963, hom. illeg. TYPE: Madagascar. Toamasina: Antsinanana, Vatomandry, près d'Analatsara, 3 Oct. 1903, *J. Guillot 36* (holotype, G; isotype, K).

Distribution and IUCN Red List category. *Gaertnera guillotii* is known from along generally the entire east coast of Madagascar, in the provinces of Antsiranana, Fianarantsoa, Toamasina, and Toliara at 0–920 m. This species is widely distributed and apparently common in eastern littoral and low-elevation humid forest from Fort Dauphin to Vohemar, and is present in the protected areas of Betampona, Mananara-Nord, Manombo, and Masoala. With a large geographic range size (EOO = 76,132 km^2) and more than 25 locations, *G. guillotii* is here considered to be of Least Concern (LC).

See Malcomber and Taylor (2009: 621–622) for a species description; the calyx lobe length there was incorrectly described as "2–3 mm;" this should read "0.2–0.3 mm."

12. **Gaertnera hirsuta** C. M. Taylor, sp. nov. TYPE: Madagascar. Toamasina: Analanjirofo, Maroantsetra, Anjahana, Andranofotsy, Farankaraina Forest, 15°27′S, 49°51′E, [no elevation], 20 June 2003, *P. Antilahimena 1954* (holotype, MO-6011480!; isotypes, K n. v., P n. v., TAN n. v.). Figure 3A–D.

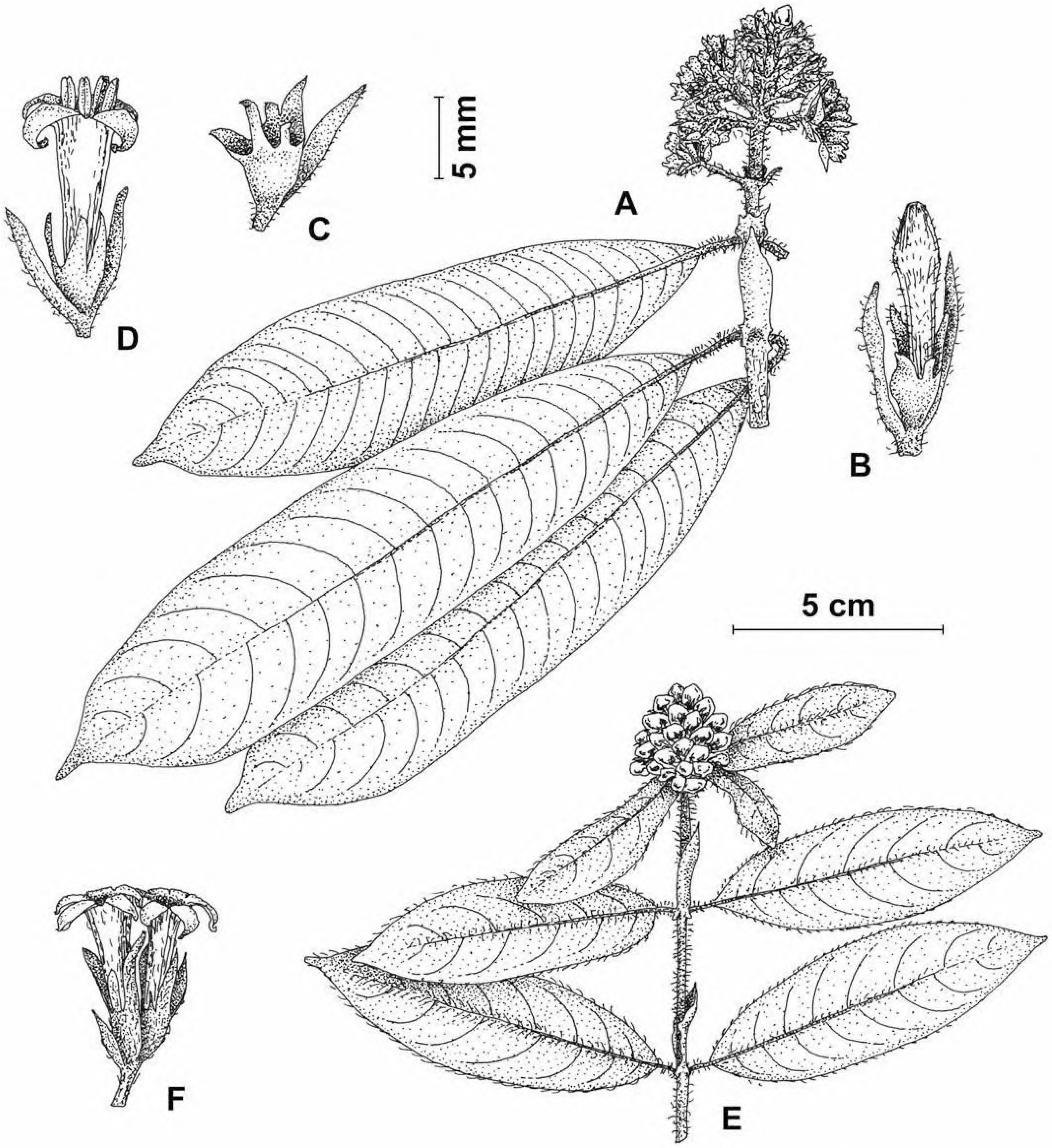

Figure 3. A–D. *Gaertnera hirsuta* C. M. Taylor. —A. Fruiting branch; based on *S. Malcomber 2833* (MO). —B. Flower bud. —C. Flower from which corolla has fallen. —D. Flower at anthesis; based on *P. Antilahimena et al. 1823* (MO). B, C, based on *D. A. Simpson 88/29* (MO). E, F. *Gaertnera phanerophlebia* Baker. —E. Fruiting branch, based on *J. Tosh 123* (MO). —F. Portion of inflorescence with two flowers at anthesis; based on *P. De Block et al. 1804* (MO). A, E, to same 5-cm scale; B–D, F, to same 5-mm scale.

Haec species a *Gaertnera ianthina* Malcomber pubescentia hirsuta, bracteolis longioribus atque calyce intus glabro lobis longioribus distinguitur.

Shrubs and small trees to 8 m tall, drying grayish green; branchlets 2.5–4 mm diam., flattened to subterete, hirsute later becoming glabrescent, the trichomes drying whitened. Leaves opposite; blades narrowly elliptic to elliptic-oblong, 11.5–22 × 2.2–6.2 cm, drying stiffly papery to chartaceous and matte, adaxially glabrous throughout or hispidulous to hispid on midrib with trichomes deciduous leaving pustulose bases, abaxially hirsute to pilose throughout or glabrous on lamina, at base cuneate to rounded, at apex abruptly narrowly acuminate with tips 5–15 mm; secondary veins 14 to 30 pairs, abaxially prominent, without domatia, with tertiary veins subparallel and prominulous abaxially; petioles 5–15 mm, hirsute to glabrescent; stipules calyptrate, hirsute to glabrescent, drying membranaceous and reddish brown, deciduous through fragmentation, 25–

60 mm, with thinly prominent ribs, with rounded wings 1.5–2.5 mm wide and developed only below petioles, apex with 1 incision, narrowly triangular, ca. 4 mm, perhaps lobed. Inflorescences subcapitate to congested cymose, many-flowered (50+), terminal on principal branches, erect, densely hirsute, subsessile to pedunculate, peduncle to 2.5 cm; branched portion broadly pyramidal to corymbiform, 4–7 × 4–8 cm, branched to 2 to 4 orders; bracts narrowly triangular to narrowly ligulate, 8–18 mm; bracteoles triangular to ligulate, 3–9 mm, often fused to base of calyx limb or inserted shortly above its base; pedicels to 2 mm. Flowers mixed sessile and pedicellate, with biology unknown, 5-merous; calyx cupuliform, 3–4 mm wide, externally hispidulous to glabrescent, internally glabrous, tube 2.5–4 mm, lobed, lobes 5, narrowly triangular, 1.5–6 mm, unequal with variously 1 to 3 lobes more than twice as long as shortest lobe; corolla in bud obtuse, at anthesis funnelform, white, externally hirsute at least in upper 1/2–2/3, internally not seen, tube ca. 11 mm, funnelform, ca. 2.5 mm diam. near middle, lobes triangular, ca. 5.5 mm, at apex a little thickened abaxially, smooth adaxially; anthers in presumed short-styled form ca. 3 mm, exserted; stigmas not seen. Drupes subglobose to subglobose-ovoid, 6–8 mm diam., becoming white then blue-black; pyrenes 2, hemispherical, abaxially smooth to angled or with 3 or 4 longitudinal sulci.

Habitat, distribution, and phenology. *Gaertnera hirsuta* is known from humid forests at 0–600 m in the Masaola Peninsula region of province of Toamasina and the region of Analanjirofo, often near streams and rivers. *Gaertnera hirsuta* has been collected in flower in January, February, and August and in fruit in July, August, and October, often concurrently with the flowers.

IUCN Red List category. *Gaertnera hirsuta* is known from the Bay of Antongil region including the Masoala protected area. With expected continuing decline outside of the protected area due to habitat conversion, a restricted geographic range size (EOO = 563 km^2; AOO < 500 km^2), and only four known locations, *G. hisuta* is here considered to be Endangered [EN B1ab(iii)+2ab(iii)].

Discussion. This new species is characterized by its distinctive hirsute pubescence, and the species epithet refers to this. *Gaertnera hirsuta* is very similar in aspect and drying color to *G. ianthina* Malcomber, which is found widely in Madagascar; *G. ianthina* differs in its appressed strigose pubescence; generally shorter petioles, 4–9 mm; leaves often with fewer secondary veins, in 14 to 20 pairs; shorter bracteoles, 0.1–2 mm; calyx with a ring of trichomes in the interior and shorter lobes, 0.5–2.5 mm; and pink to purple shorter corollas, with the tube 7–9 mm long (for contrasting character states of *G. hirsuta*, see its description above). However, *G. hirsuta* has been primarily confused with *G. phanerophlebia* Baker, and the illustration of *G. phanerophlebia* presented by Malcomber and Taylor (2009: 623, fig. 11G–M) actually represents *G. hirsuta*. Accordingly a revised description and an illustration (Fig. 3E, F) of *G. phanerophlebia* are presented in this article. *Gaertnera phanerophlebia* is found in northern to east-central Madagascar and can be separated from this new species by its smaller leaves, 3–14.5 × 1.4–4.5 cm, with fewer secondary veins, in 6 to 15 pairs, and the tertiary venation not visible; capitate to only shortly cymose inflorescences; reddish brown drying color; and shorter corolla lobes, ca. 3 mm.

Paratypes. MADAGASCAR. **Toamasina:** Analanjirofo, Maroantsetra, Ambinanitelo, Soanafindra, Anjanaharibe forest, 15°11′S, 49°37′E, *P. Antilahimena, Pascal & Ramaroson 1823* (MO, P, TAN); Maroantsetra, Andranofotsy river, E of village of Sahavary, *D. A. Simpson 88/29* (K, MO); Andronobe, Masoala Peninsula, Masaola Nat. Park, W coast, Andranobe, *Möise & Solo 10* (MO, P, TAN), *Möise & Solo 10A* (MO, P, TAN), beside Andranobe River, *S. T. Malcomber 2830* (K, MO, P, TAN), 3.8 km E of Andranobe, Be Dinta Camp, 15°40′S, 49°58–59′E, *S. T. Malcomber 2833* (K, MO, P, TAN), *M. L. Zjhra & J. Hutcheon 445* (K, MO, P, TAN); Masaola Peninsula, S of village of Ambanizana in Andranobe River watershed, 15°40′S, 49°58′E, *N. Vasey & N. Velo 32* (K, MO, P, TAN).

13. Gaertnera hispida Aug. DC., Bull. Herb. Boissier, Sér. 2, 1: 585. 1901. TYPE: Madagascar. Toamasina: Analanjirofo, Maroa [Maroantsetra], *A. Mocquerys 155* (lectotype, designated by Malcomber & Taylor [2009: 623], G-DC).

Distribution and IUCN Red List category. *Gaertnera hispida* is found in northeastern Madagascar in the provinces of Antsiranana and Toamasina at 0–300 m. It occurs in lowland humid forest from the Mananara-Nord protected area to the Bay of Antongil, including in the Masoala protected area. With expected continuing decline outside of the protected areas due to habitat degradation and conversion, a restricted geographic range size (EOO = 2822 km^2; AOO ca. 1000 km^2), and only eight locations, *G. hispida* is here considered to be Vulnerable [VU B1ab(iii)+2ab(iii)].

See Malcomber and Taylor (2009: 622–624) for a species description.

14. Gaertnera humblotii Drake, Bull. Soc. Bot. France 45: 352. 1899, as "Humbloti." TYPE:

Madagascar. "N. E. Madagascar," *L. Humblot 655* (holotype, P; isotypes, MO, P, WU).

Distribution and IUCN Red List category. *Gaertnera humblotii* is found in east-central to northeastern Madagascar at 0–600 m in the provinces of Antsiranana and Toamasina. It is known from humid lowland forests from west of Brickaville to Marojejy. Although it is present in the protected areas of Marojejy, Masoala, and Zahamena, the subpopulations outside of protected areas are expected to experience continuing decline due to forest degradation and clearing. Therefore, with a restricted geographic range size (EOO = 18,021 km^2), and only 10 locations, *G. humblotii* is here considered to Vulnerable [VU B1ab(iii)].

Discussion. See Malcomber and Taylor (2009: 624) for a species description. This species was characterized there by its calyx with well-developed, unequal, generally spathulate lobes 5–7 mm long. However, some recent collections (e.g., *Andrianarisata et al. 158*, MO) have some calyx lobes that are shorter than this, to as short as 3.5 mm; these updated measurements are used in the Key to Species here.

15. **Gaertnera ianthina** Malcomber, Ann. Missouri Bot. Gard. 96(4): 624, fig. 5G, H. 2009. TYPE: Madagascar. Antsiranana: SAVA, Marojejy Nat. Reserve, near camp 2 on summit trail, 800–1000 m, 17 Sep. 1997, *S. T. Malcomber 2773* (holotype, MO; isotypes, A, BR, G, K, P, PRE, TEF, WAG).

Distribution and IUCN Red List category. *Gaertnera ianthina* is found in northern and northeastern Madagascar, in the provinces of Mahajanga, Antsiranana, and Toamasina at 0–1700 m. It is widely distributed in humid to subhumid forest from Mananara-Nord and the Bay of Antongil across the northern mountains to the Sambirano region and is present in the protected areas of Anjanaharibe-Sud, Mananara-Nord, Manongarivo, Marojejy, Masoala, and Tsaratanana. With a large geographic range size (EOO = 25,116 km^2) and more than 25 locations, *G. ianthina* is here considered to be of Least Concern (LC).

Discussion. See Malcomber and Taylor (2009: 624–625) for a species description. This species is similar in general aspect and many details to *Gaertnera hirsuta*; see the discussion of that species for their distinction, above.

16. **Gaertnera inflexa** Boivin ex Baill., Adansonia 12: 237–238. 1879. TYPE: Madagascar. Toamasina: Analanjirofo, ad S.-Mariam, Tafondrou, Jan. 1848, *L.-H. Boivin 1778* (lectotype, designated in Malcomber & Taylor [2009: 625], P; isolectotype, G).

Distribution and IUCN Red List category. *Gaertnera inflexa* is known from northeastern to east-central Madagascar, in the provinces of Antsiranana and Toamasina at 0–520 m. It is widely distributed in humid forest from Mahanoro to the Masoala peninsula and is present in the protected areas of Ambatovaky, Mananara-Nord, Masoala, and Nosy Mangabe as well as the conservation site of Analalava. With a large geographic range size (EOO = 25,757 km^2) and 13 locations, *G. inflexa* is here considered to be of Least Concern (LC).

See Malcomber and Taylor (2009: 625–626) for a species description and synonymy.

17. **Gaertnera laevis** C. M. Taylor, sp. nov. TYPE: Madagascar. Toamasina: Analanjirofo, 3–4 km W of Maroantsetra along Rte. Nationale 4, 15°28′S, 49°42′E, 10 m, 1 Dec. 1987, *G. E. Schatz & J. F. Villiers 1811* (holotype, MO-3637804!; isotypes, K n. v., P n. v., TAN n. v.). Figure 4A–C.

Haec species a *Gaertnera obovata* var. *sphaerocarpa* (Baker) Malcomber foliis elliptico-oblongis ad elliptico-oblanceolatis basi obtusis usque rotundatis, alis petiolos circumcinctis reductis atque bracteis bene evolutis distinguitur.

Small trees to 12 m tall, drying brown; branchlets 3–4 mm diam., quadrangular, glabrous. Leaves opposite; blades elliptic-oblong to elliptic-oblanceolate, 10.5–20 × 3.5–6.5 cm, drying papery to chartaceous and matte, glabrous on both surfaces, at base obtuse to rounded, at apex rounded to obtuse then abruptly acuminate with tips 5–10 mm; secondary veins 5 to 10 pairs, thinly prominulous abaxially, usually with foveolate domatia 0.2–0.5 diam., with intersecondary and tertiary venation at least weakly visible abaxially; petioles 5–25 mm, glabrous; stipules calyptrate, glabrous, drying membranceous and reddish brown, caducous and sometimes fragmenting, 30–60 mm, apparently smooth, with wings absent or encircling only lower part of petiole, rounded, up to 0.5 mm wide, apex with 1 incision, with 2 linear lobes ca. 2 mm. Inflorescences laxly cymose, many-flowered (50+), terminal on principal branches, erect, sparsely to densely puberulous-hirtellous to pilosulous with pubescence often in patches or lines, pedunculate; peduncle 3–6 cm; branched portion pyramidal, 8–18 × 10–18 cm, branched to 3 to 5 orders; bracts narrowly lanceolate, narrowly ligulate, or narrowly elliptic, 4–50 mm, or

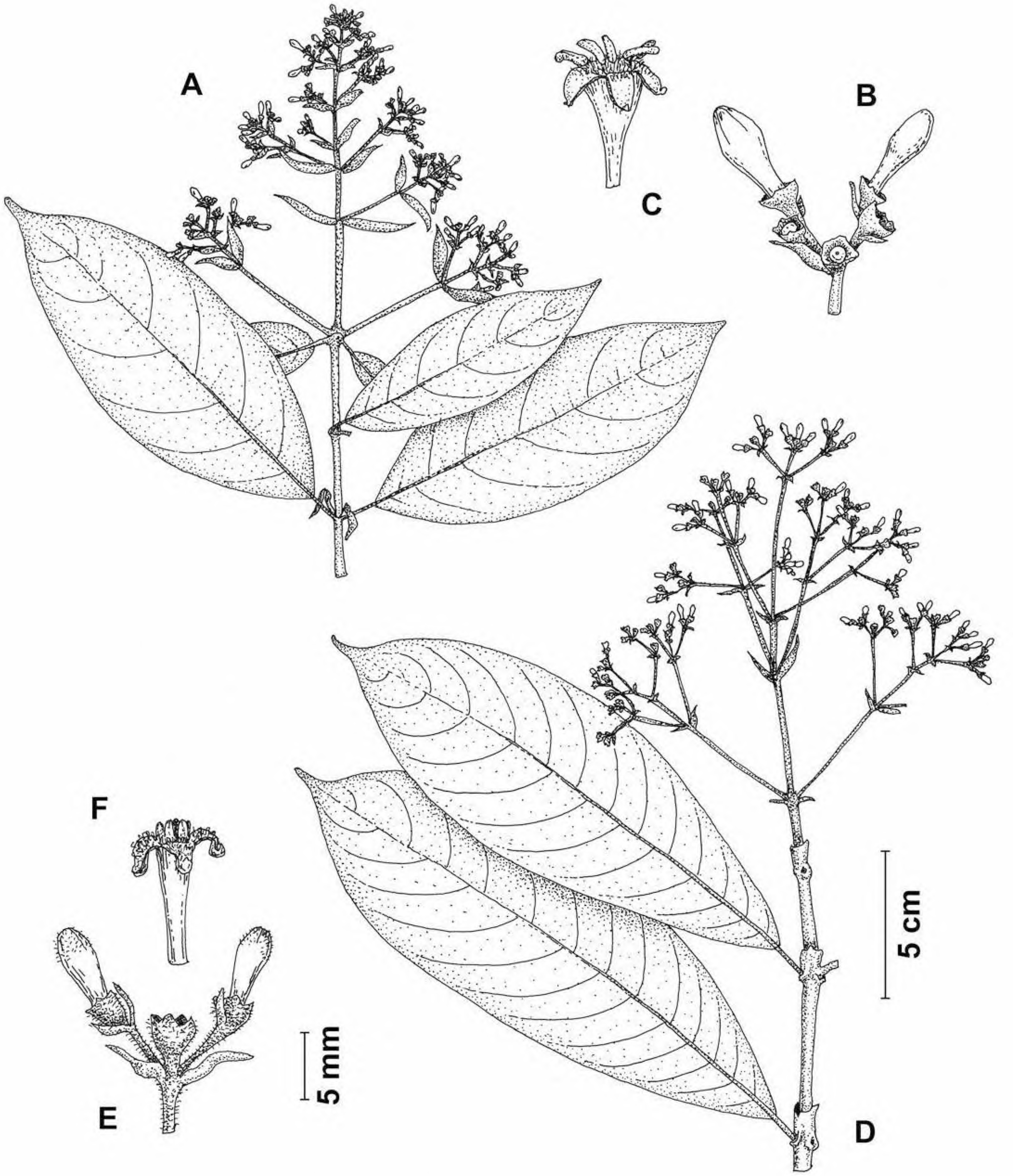

Figure 4. A–C. *Gaertnera laevis* C. M. Taylor. —A. Flowering branch; based on *G. E. Schatz & E. Carlson 2842* (MO). —B. Portion of inflorescence, with two flower buds and three flowers from which corollas have fallen. —C. Corolla at anthesis, dissected off flower. B, C, based on the type *G. E. Schatz & J. F. Villiers 1811* (MO). D–F. *Gaertnera rakotovaoana* C. M. Taylor; based on the type *C. Rakotovao et al. 2707* (MO). —D. Flowering branch. —E. Portion of inflorescence with two flower buds and one flower from which corolla has fallen. —F. Corolla at anthesis, dissected off flower. A, D, to same 5-cm scale; B, C, E, F, to same 5-mm scale.

those subtending basalmost secondary axes sometimes foliaceous and stipitate; bracteoles triangular to ovate or 3-lobed, 1–5 mm, often fused to base or lower part of calyx tube; pedicels to 2 mm. Flowers sessile to subsessile and sometimes also pedicellate, distylous, 5-merous; calyx cupuliform, 1.5–2.5 mm wide, glabrous externally and internally, tube 1–1.8 mm, often with upper portion markedly paler and thinner in texture, truncate to denticulate, teeth 4 or 5, triangular, 0.2–0.5 mm and subequal or sometimes on some flowers, 1 tooth 0.8–1.5 mm; corolla in bud obtuse, at anthesis salverform, white flushed with lavender, externally glabrous, internally densely pilosulous on upper part of tube and onto lobes, tube 7.5–8 mm, cylindrical to funnelform, ca. 1.5 mm diam. near middle, lobes triangular to ligulate, ca. 2 mm, at apex abaxially a little thickened, adaxially with thickened hook; anthers in short-styled form ca. 2 mm, exserted, in long-styled form not seen; stigmas in short-styled form 1–1.2 mm, positioned in or just below corolla throat, in long-styled form ca. 0.4 mm, well exserted. Drupes ovoid to ellipsoid, 8–10 × 5–8 mm, mature color not noted or possibly green; pyrenes 2, hemispherical, smooth abaxially.

Distribution, habitat, and phenology. *Gaertnera laevis* is known from humid forests at 0–450 m in the provinces of Antsiranana (SAVA) and Toamasina (Analanjirofo). *Gaertnera laevis* has been collected in flower in November and December and in fruit in February, March, September, and November.

IUCN Red List category. *Gaertnera laevis* is known from the Bay of Antongil region including the Masoala and Nosy Mangabe protected areas. With expected continuing decline outside of the protected areas due to habitat degradation and conversion, a restricted geographic range size (EOO = 1415 km^2; AOO ca. 900 km^2), and only nine known locations, *G. laevis* is here considered to be Vulnerable [VU B1ab(iii)+2ab(iii)].

Discussion. *Gaertnera laevis* can be recognized by the combination of its thin-textured calyptrate stipules without wings or with the wings reduced and only encircling the lower part of the petioles; relatively large, petiolate, elliptic-oblong to elliptic-oblanceolate leaves that are obtuse to rounded at the base; paniculiform, usually lax, rather large inflorescences; and slender, white to pale lavender corollas with rather well-developed tubes. The species epithet refers to the smooth attachment of the petioles with the stem, generally without developed wings or stipular ridges. *Gaertnera laevis* also has well-developed bracts, in particular those subtending the basalmost node or several basalmost nodes of the inflorescence. These are often foliaceous and narrowed to a stipitate (or petiolate) base. One specimen, *McPherson & Rabenantoandro 18383*, has an inflorescence with numerous foliaceous bracts at nodes without flowers, or depending on morphological interpretation, alternatively in having the stems branched to several orders with each of these branches bearing reduced leaves at three to five nodes and terminating in a small inflorescence, 2–3 × 2–3 cm and branched to only two orders.

The plants included here in *Gaertnera laevis* were previously included by Malcomber and Taylor (2009) within the circumscription of *G. obovata* var. *sphaerocephala*, based on their well-developed calyptrate stipules and generally similar flowers. However, *G. obovata* var. *sphaerocephala* is circumscribed more narrowly here. This variety is found widely in Madagascar and can be separated from *G. laevis* by its oblanceolate to obovate leaves that are cuneate to acute at the base, stipules with developed basal ridges that extend into wings and at least partially encircle the petioles, usually smaller inflorescences with the branched portion 2–13 × 4–18 cm, and generally smaller bracts, 1.5–8 mm, and bracteoles, 1–2 mm (for contrasting characters of *G. laevis*, see its description above). Additionally *G. obovata* var. *sphaerocephala* usually has corollas with the tube 2–2.5 times as long as the lobes versus the corolla tube ca. 4 times as long as the lobes in *G. laevis*.

Paratypes. MADAGASCAR. **Antsiranana:** SAVA, Parc National de Masoala, 22 km de la ville d'Ampanavoana, sur la route d'Ifasina, 15°41′S, 50°15′E, *J. Aridy & G. Rahajasoa 103* (MO); Ambodilaitra, Vinanivao, Antalaha, presqu'île de Masoala, 15°59′S, 50°11′E, *J. Rabe, G. M. Rahajasoa & Roger 183* (MO). **Toamasina:** Analanjirofo, Parc Nat. Masoala, Maroantsetra, Ambanizana, 15°43′S, 49°58′E, *J. Aridy & J. Toly 283* (K, MO); SE of village of Ambanizana, along ridge SE of Androka River, SE of Maroantsetra, NW coast Masoala Peninsula, *P. P. Lowry II, A. Rakotozafy & M. F. Nicoll 4132* (K, MO); Masoala Peninsula, S of Ambizana, Andronabe permanent plot, 15°31′S, 59°58′E, *S. T. Malcomber, F. Andriatsifera, J. Gerard & Moise 2735A* (MO); Masoala Nat. Park, W coast, near Andranobe, trail S Androka River, 15°38′S, 49°58′E, *S. T. Malcomber 2819* (MO); Masoala Peninsula, Andranobe, S of Ambanizana, 15°41′S, 49°58′E, *G. McPherson, P. Harimalala, P. Hoffmann & T. Robinson 17569* (MO); Ambanizana, 15°38′S, 49°58′E, *Möise 7* (MO); Morantsetra, Tampolo, Péninsule Masoala, entre Ambodiforaha & Laotrozo, 15°42′S, 49°59′E, *P. Poncy, S. Rapanarivo, F. Mathias & J. Y. Serein 1563* (K, MO, P); Masoala Peninsula, S of village of Ambanizana in Andranobe River watershed, 15°40′S, 49°58′E, *J. Rabe, N. Vasey, F. Andrianatsiferana & N. Veb 34* (MO); Parc Nat. Masoala, Antalavia, 15°47′S, 50°02′E, *G. Rahajasoa, R. Bernard & J. Rabe 988* (MO); massif of Ankirindo, ca. 25 air-km NW Maroantsetra via Antainambalana then Vohimaro rivers, 15°18′S, 49°33′E, *G. E. Schatz, P. P. Lowry II, J. Rabenantoandro, R. Bernard & G. Modeste 3888* (MO); Nosy Mangabe island in Bay of Antongil, 5 km S Maroantsetra, 15°30′S, 49°46′E, *G. E. Schatz & J. F. Villiers 1824* (K, MO), *G. E. Schatz & E. Carlson 2842* (K, MO).

18. Gaertnera littoralis C. M. Taylor, sp. nov. TYPE: Madagascar. Toamasina: Analanjirofo, Soanierana-Ivongo, comune rural Manopana, 16°46′S, 49°43′E, 2 Feb. 2003, *R. Rabevohitra, J. Rabenantoandro & R. Razakamalala 4350*

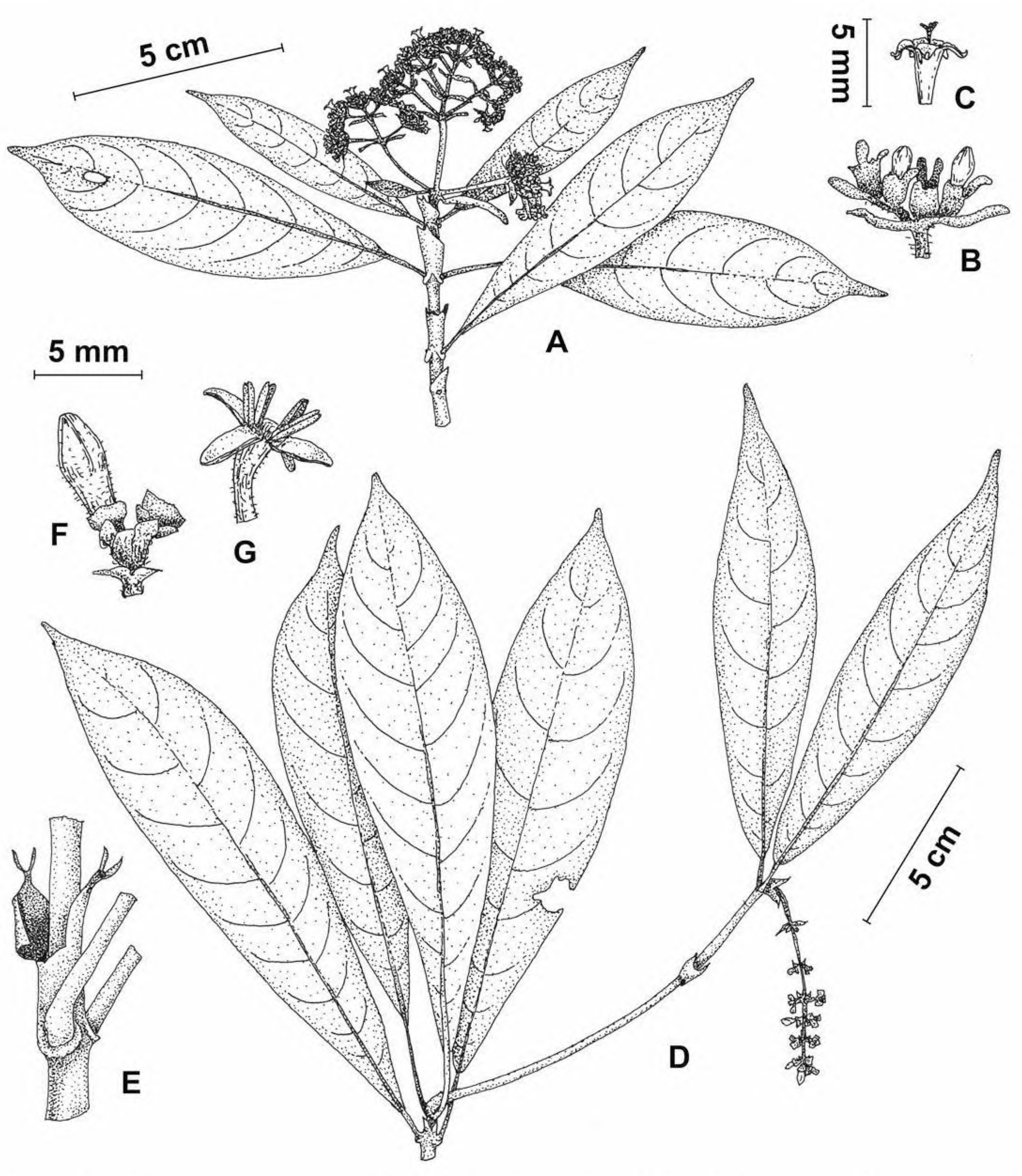

Figure 5. A–C. *Gaertnera masoalana* C. M. Taylor; based on *Moïse 4* (MO). —A. Flowering branch. —B. Portion of inflorescence with two flower buds and two flowers from which corollas have fallen. —C. Corolla at anthesis, dissected off flower together with style. D–G. *Gaertnera littoralis* C. M. Taylor. —D. Flowering branch, based on *G. E. Schatz et al. 3669* (MO). —E. Portion of stem with node, basal parts of two petioles, and stipule, based on *R. Razakamalala et al. 755* (MO). —F. Portion of inflorescence with one flower bud and one flower from which corolla has fallen. —G. Corolla at anthesis, dissected off flower. F, G, based on the type *R. Rabevohitra et al. 4350* (MO). B, C, E to same 5-mm scale; F, G to same 5-mm scale.

(holotype, MO-04845541!; isotypes, P n. v., TAN n. v.). Figure 5D–G.

Haec species a *Gaertnera cardiocarpa* Boivin ex Baill. foliis oblanceolatis ad angustioribus oblanceolatis venatione tertiaria non manifesta atque corolla breviore distinguitur; etiam sylvas littorales ad substrata arenosa plerumque habitat.

Shrubs and small trees to 4 m tall, drying brown; branchlets 2–3 mm diam., weakly quadrate to terete, glabrous. Leaves opposite; blades oblanceolate to narrowly oblanceolate, 5–17 × 1–4 cm, drying chartaceous and matte, glabrous on both surfaces, at base acute, at apex acuminate with tips 8–15 mm; secondary veins 6 to 11 pairs, plane or thinly prominulous abaxially, without domatia, with remaining venation not visible abaxially; petioles 3–15 mm, glabrous; stipules tubular, glabrous, drying membranaceous to papery and brown, glabrous, persistent or deciduous via fragmentation, tube 7–11 mm, with thin ridges extending from lobes to petioles, with flat to rounded ridges 0.3–0.5 mm wide encircling petioles, at apex with 1 incision, with lobes 4, linear, 1.5–3 mm, strigillose to glabrous. Inflorescences cymose, several- to many-flowered (15 to 40), terminal on principal branches, deflexed to pendulous, glabrous, subsessile to pedunculate, peduncles to 2.5 cm; branched portion narrowly pyramidal, 1–4 × 1–2 cm, branched to 1 or 2 orders; bracts ovate or 3-lobed, 1–2 mm, often membranaceous, or those subtending basalmost secondary axes sometimes stipuliform; bracteoles ovate to deltate, 1–1.5 mm. Flowers sessile or subsessile, biology unknown, 4-merous; calyx cupuliform, 1–2 mm wide, externally glabrous, internally with a sparsely to densely pubescent ring or ridge near middle, tube 1–1.2 mm, truncate to denticulate, teeth 4, minute; corolla in bud obtuse to acute, at anthesis salverform, white, glabrous to puberulous or sparsely hirtellous externally, internally barbate in throat, tube ca. 3.5 mm, cylindrical to narrowly funnelform, ca. 0.8 mm diam. near middle, lobes narrowly ligulate, ca. 2.2 mm, at apex abaxially a little thickened, abaxially generally smooth; anthers in presumed short-styled form ca. 2 mm, shortly exserted; stigmas in presumed short-styled form ca. 0.8 mm, included, positioned just above base of corolla tube. Drupes subglobose, ca. 8 × 8 mm, black; pyrenes 2, hemispherical, smooth abaxially.

Habitat, distribution, and phenology. *Gaertnera littoralis* is known from littoral and humid lowland forest on sand substrates at 8–50 m in the provinces of Antsiranana (SAVA) and Toamasina (Analjarifo and Atsinanana). *Gaertnera littoralis* has been collected in flower in February, October, and November and in fruit in May.

IUCN Red List category. *Gaertnera littoralis* is known from only five collections from Mangalimaso, west of Foulepointe, to the Masoala Peninsula. With a very restricted geographic range size (EOO = 3965 km^2; AOO ca. 200 km^2), expected continuing decline outside of the Masoala protected area because of habitat degradation and conversion, and only three locations, *G. littoralis* is here considered to be Endangered [EN B1ab(iii)+2ab(iii)].

Discussion. *Gaertnera littoralis* is known from several habitats including littoral forests, and the species epithet refers to this particular habitat. It is similar in general aspect to *G. drakeana*, which is found from northeastern Madagascar to the Bay of Antongil region; *G. drakeana* differs in its subcapitate to only very shortly branched inflorescences, generally larger calyx 2–3.5 mm wide, 5-merous flowers, larger corollas with tubes 5–6 mm and lobes 4–7 mm, and habitat in humid forest on nonsand substrates (for contrasting characters of *G. littoralis*, see its description above). *Gaertnera littoralis* is also similar to *G. cardiocarpa*, which is also found from northeastern Madagascar to the Bay of Antongil region; *G. cardiocarpa* differs in its leaves that are generally widest at the middle and have the secondary and tertiary venation well developed and visible, inflorescences with regularly developed tertiary axes, larger corollas with tubes 5–6 mm and lobes 3.5–5 mm long, and habitat in humid forest on nonsand substrates.

Paratypes. MADAGASCAR. **Antsiranana:** SAVA, Masoala Peninsula, 3 km SW of "Tamany Fred," watershed of the Anaovandrano River, 15°46′S, 50°12′E, *G. E. Schatz, J. Dransfield, S. Dransfield & R. Bernard 3669* (MO, P, TAN). **Toamasina:** Analanjirofo, N of Soanierana-Ivongo, Mamambao, near village of Antanambao-Ambodimanga, 16°45–46′S, 49°43′E, *G. McPherson, J. Rabenantoandro & R. Razakamalala 18952* (MO, P, TAN), *R. Razakamalala, D. Rabehevitra, S. N. Andrianarivelo & M. Fotsy 755* (MO, P, TAN). Atsinanana: Mangalimaso, a l'O de Foulpointe, *Capuron in Service Forestier 22095* (MO, P).

19. Gaertnera lowryi Malcomber, Ann. Missouri Bot. Gard. 96(4): 632–633, fig. 7C–H. 2009. TYPE: Madagascar. Toamasina: Analanjirofo, Masaola Nat. Park, West Coast, near Antalavia, 0.8 km NE of village, lowland forest beside Antalavia River, 50–150 m, 12 Oct. 1997, *S. T. Malcomber 2827* (holotype, MO; isotypes, BR, G, K, P, PRE, TEF, WAG).

Distribution and IUCN Red List category. *Gaertnera lowryi* is known from northeastern Madagascar, in the province of Toamasina at 0–490 m. It is known from lowland humid forest from Mananara-Nord to the Bay of Antongil region and is present in the protected areas of Makira, Mananara-Nord, and Masoala. With a restricted georaphic range size (EOO = 3514 km^2; AOO ca. 300 km^2), expected continuing decline outside of the protected areas because of habitat degradation and conversion, and only seven known locations, *G. lowryi* is here considered to be Vulnerable [VU B1ab(iii)+2ab(iii)].

See Malcomber and Taylor (2009: 632–633) for a species description.

20. Gaertnera macrobotrys Baker, J. Linn. Soc., Bot. 20: 208. 1883. TYPE: Madagascar. "Central Madagascar," *R. Baron 1945* (holotype, K; isotype, P).

Distribution and IUCN Red List category. *Gaertnera macrobotrys* is known from northeastern to southeastern Madagascar, in the provinces of Antsiranana, Toamasina, and Fianarantsoa at 50–1100 m. It is widely distributed in humid to subhumid forest up to 1000 m elevation from Vohipeno to Marojejy, and is present in the protected areas of Analamazaotra-Périnet, Marojejy, Masoala, and Ranomafana. With a large geographic range size (EOO = 47,946 km^2; AOO ca. 18,000 km^2), in spite of only nine known locations, *G. macrobotrys* is here considered to be of Least Concern [LC].

See Malcomber and Taylor (2009: 633–634) for a species description and synonymy.

21. **Gaertnera macrostipula** Baker, J. Linn. Soc., Bot. 20: 207. 1883. Madagascar. "Central Madagascar," *R. Baron 1922* (lectotype, designated by Malcomber & Taylor [2009: 634], K; isolectotypes, K, P).

Distribution and IUCN Red List category. *Gaertnera macrostipula* is found from northern to southeasten Madagascar in the provinces of Antsiranana, Toamasina, and Fianarantsoa at 0–2000 m. It is widely distributed in humid to subhumid to montane forests. With a large geographic range size (EOO = 183,361 km^2) and its presence in numerous protected areas (Analamazaotra-Périnet, Anjanaharibe-Sud, Betampona, Manombo, Manongarivo, Mantadia, Marojejy, Masoala, Ranomafana, and Zahamena), *G. macrostipula* is here considered to be of Least Concern (LC).

See Malcomber and Taylor (2009: 634–635) for a species description and synonymy. The description there corresponds to the circumscription of the species here, but some specimens that were previously included in *Gaertnera macrostipula* are here excluded and classified instead in the newly described species *G. sclerophylla*, *G. velutina*, and *G. robusta*. The distinctions among these are discussed under each of these newly described spcies. *Gaertnera macrostipula* as circumscribed here is found in a variety of habitats, and can be recognized by its well-developed persistent stipules with the tube often inflated, generally covering most or all of the internode above it and becoming marcescent along the margins; calyx with well-developed lobes 1–3.5 mm; and usually larger flowers with corolla tubes 6.5–9 mm. Malcomber and Taylor (2009) described the calyces of *G. macrostipula* as variously lobed or truncate, but as circumscribed here *G. macrostipula* has lobed calyces, and the plants with truncate or subtruncate calyces are here included in *G. sclerophylla* and *G. nitida*.

22. **Gaertnera madagascariensis** (Hook. f.) Malcomber & A. P. Davis, Monogr. Syst. Bot. Missouri Bot. Gard. 104: 388, figs. 4, 5. 2005. *Hymenocnemis madagascariensis* Hook. f., Gen. Pl. 2: 133. 1873. TYPE: Madagascar. s. loc., *W. Bojer s.n.* (holotype, K).

Distribution and IUCN Red List category. *Gaertnera madagascariensis* is known from northeastern to southeastern Madagascar in the provinces of Antsiranana, Toamasina, Antananarivo, and Fianarantsoa at 850–1600 m. It is widely distributed in subhumid forest around the eastern escarpment. With a large geographic range size (EOO = 40,923 km^2) and its presence in the protected areas of Analamazaotra-Périnet, Andringitra, Anjanaharibe-Sud, and Ranomafana, *G. madagascariensis* is here considered to be of Least Concern (LC).

See Malcomber and Taylor (2009: 635) for a species description and synonymy.

23. **Gaertnera malcomberiana** C. M. Taylor, sp. nov. TYPE: Madagascar. Antsiranana: SAVA, Anjanaharibe-Sud, Takhtajania trail, 14°45′S, 49°29′E, 1006 m, 14 Feb. 2006, *J. Tosh, P. De Block, F. Rakotonasolo & Ravenlonarivo 383* (holotype, MO-04812789!; isotypes, BR n. v., K n. v., P n. v., TAN n. v., UPS n. v.). Figure 6A, B.

Haec species a *Gaertnera ianthina* Malcomber foliis obovatis oblanceolatisve pubescentia adpressa aparenter arachnoidea sericea indutis distinguitur.

Shrubs to 6 m tall, drying grayish brown; branchlets 4–5 mm diam., flattened, strigillose with trichomes drying white to glabrous, with epidermis quickly becoming corky and thickened. Leaves opposite or ternate; blades obovate to oblanceolate, 14–21 × 4–8.8 cm, drying stiffly papery to chartaceous and matte, adaxially glabrous, abaxially glabrous on lamina and densely tangled-sericeous or lanose on midrib, secondary veins, and sometimes tertiary veins with trichomes often drying whitened and sometimes tardily deciduous, at base acute then sometimes shortly abruptly rounded, at apex obtuse to rounded then abruptly acuminate with tips 3–6 mm; secondary veins in 12 to 17 pairs, abaxially prominent, without domatia, with tertiary veins subparallel and prominulous abaxially; petioles 3–12 mm, glabrous; stipules calyptrate, glabrous, drying membranaceous and reddish brown, deciduous via fragmentation, 18–20 mm, perhaps smooth, with wings 1–2 mm wide encircling petioles and quickly becoming corky and thickened, at apex with 1

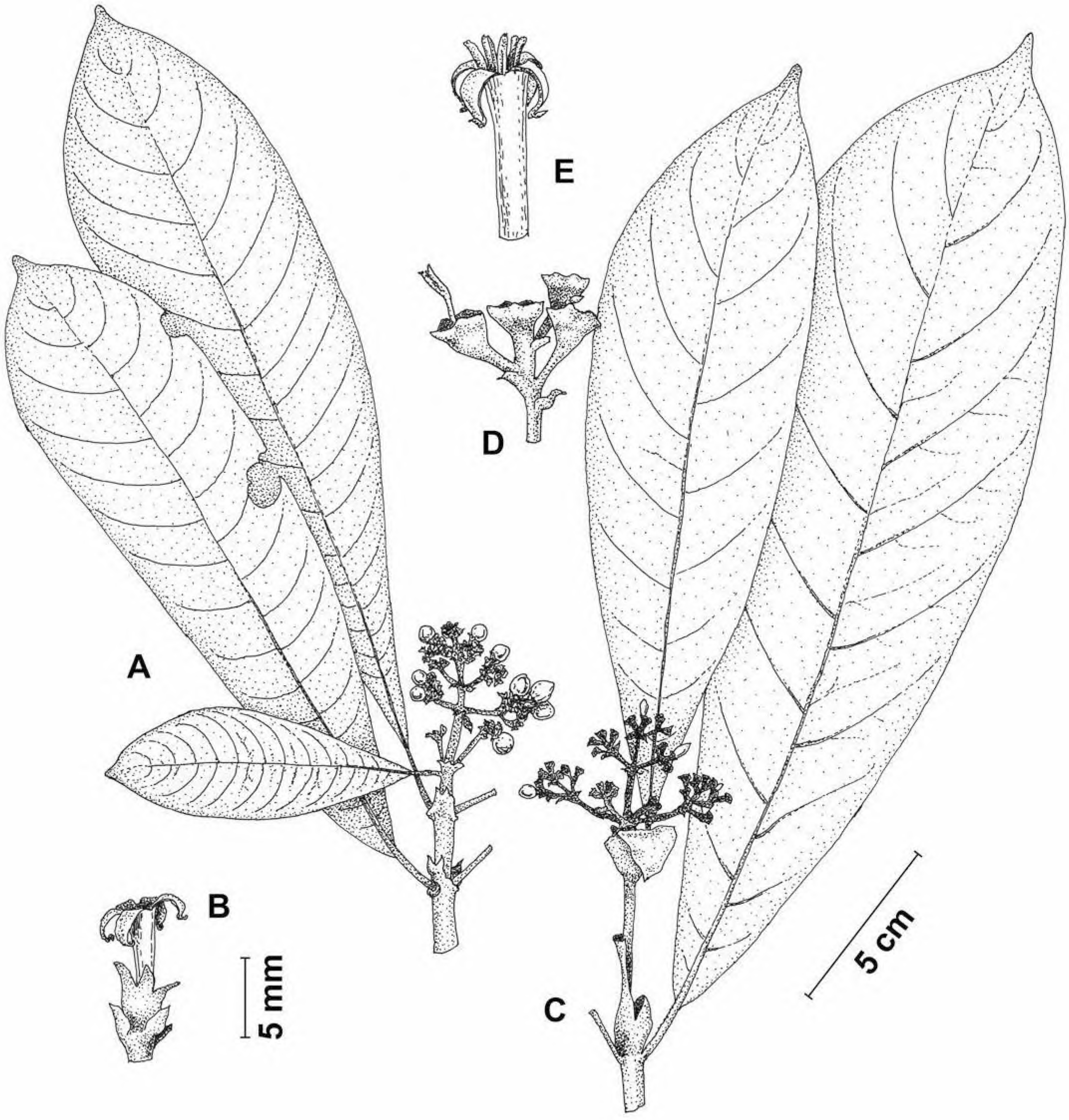

Figure 6. A, B. *Gaertnera malcomberiana* C. M. Taylor. —A. Fruiting branch; based on *Lewis 1318* (MO). —B. Portion of inflorescence with one flower at anthesis; based on the type *J. Tosh et al. 383* (MO). C–E. *Gaertnera rubra* C. M. Taylor; based on the type *L. M. Randrianjanaka 214* (MO). —C. Flowering branch. —D. Portion of inflorescence with four flowers from which corollas have fallen, one flower with persistent style with stigmas. —E. Corolla at anthesis, dissected off flower. A, C, to same 5-cm scale; B, D, E, to same 5-mm scale.

incision, complete apex not seen. Inflorescence congested cymose, many-flowered (50+), terminal on principal branches, erect, strigillose or lanose-strigose to glabrous, subsessile to pedunculate, peduncles to 0.8 cm; branched portion broadly pyramidal to corymbiform, 3.8–6 × 3.8–6 cm, branched to 2 to 4 orders; bracts narrowly triangular, 6–8 mm; bracteoles triangular, 3–4 mm, often fused to base or lower part of calyx; pedicels to 1 mm. Flowers mixed subsessile and pedicellate, with biology unknown, 5-merous; calyx cupuliform, 2.5–3 mm wide, externally glabrous, internally glabrous except strigillose in a ring near middle, tube 2.5–4 mm, lobed, lobes 5, narrowly triangular, 1.5–2.5 mm, subequal to a little unequal; corolla in bud obtuse, at anthesis salverform, white in basal part and pink above, externally glabrous, internally not seen, tube ca. 8.5 mm, cylindrical, ca. 1 mm diam. near middle, lobes triangular, ca. 2 mm, at apex abaxially with appendage ca. 0.1 mm, adaxially smooth; anthers and stigmas not seen. Drupes ellipsoid to ovoid and weakly laterally flattened with apex sometimes shortly rostrate, 7–8 × 8–9 mm, violet; pyrenes 2, hemispherical, smooth abaxially.

Habitat, distribution, and phenology. *Gaertnera malcomberiana* is known from subhumid forests at 1006–1630 m in the provinces of Antsiranana (SAVA) and Mahajunga (Sofia). *Gaertnera malcomberiana* has been collected in flower in February and in fruit in November.

IUCN Red List category. Although *Gaertnera malcomberiana* is present in the protected areas of Anjanaharibe-Sud and Marojejy, other subpopulations outside of the protected areas are expected to undergo population decline because of habitat degradation and conversion. Therefore, with a restricted geographic range size (EOO = 1449 km^2; AOO = 930 km^2) and only seven locations, *G. malcomberiana* is here considered to be Vulnerable [VU B1ab(iii)+2ab(iii)].

Discussion. *Gaertnera malcomberiana* is similar to and has been confused previously with *G. ianthina*, which is also found in northern Madagascar; *G. ianthina* can be separated by its elliptic to oblong leaves that abaxially have strigose to sericeous pubescence along the principal veins. In contrast, the characteristic pubescence of *G. malcomberiana* is unlike that of any other *Gaertnera* species seen. This pubescence resembles arachnoid pubescence, but the matted, tangled, long (to 1.5 mm), appressed trichomes are straight to crisped. These trichomes are sometimes deciduous and/or sometimes mixed with much shorter trichomes. *Gaertnera malcomberiana* is also unusual in its often ternate leaf arrangement, which is uncommon in the genus. The specific epithet of this exceptional species honors Simon Malcomber who has studied *Gaertnera* extensively across its entire range and in particular in Madagascar.

Paratypes. MADAGASCAR. **Antisiranana:** SAVA, limite entre Anjialavabe et Doany, Andapa, sommet d'Ankarangameloka, *D. Ravelonarivo, M. Patroide & German 1852* (MO, TAN); Andapa, Ambodiangezoka, Réserve Spéciale Anjanaharibe-Sud, Quartier Antsavokabe, 11 km WSW Befingotra, 14°45′S, 49°27′E, *B. Lewis, J. McDonagh & R. Desire 1318* (K, MO, P, TAN); Réserve Naturelle Intégrale no. 12 de Marojejy, 11 km NW de village Manantenina, le long d'un affluent de la rivière Manantenina, 14°26′S, 49°44′E, *P. J. Rakotomalaza, N. Messmer & D. Ravelonarivo 809* (K, MO, P, TAN); Andranotsarabe, Befingotra, Belampona, 14°42′S, 49°32′E, *F. Rasoavimbahoaka & J. A. Rastefanonirina 311* (K, MO, P, TAN), environs du sommet, 14°42′S, 49°28′E, *D. Ravelonarivo et al. 303* (MO, P, TAN), ca. 8 km près du village d'Antsavokabe, 14°40′S, 49°30′E, *D. Ravelanarivo & M. Rabarisoamanana 912* (MO, P, TAN); Réserve Spéciale Anjanaharibe-Sud, village d'Andranotsarabe, 14°45′S, 49°28′E, *D. Ravelonarivo & R. Rabesonina 499* (K, MO, P, TAN), Quartier Ambodisatrana, SW d'Andapa, au bord de la rivière Beamalona, 14°39′S, 49°26′E, *D. Ravelonarivo & R. Rabesonina 685* (MO, P, TAN); Andapa, Doany, Andranomilolo, forêt d'Andrakengy, 14°20′S, 49°18′E, *R. Razakamalala, C. Rakotovao, Landrie & José 2913* (K, MO, P, TAN). **Mahajunga:** Sofia, versant O de la Réserve Spéciale Anjanaharibe-Sud, 13 km SW de Beginotra, 14°46′S, 49°26′E, *P. J. Rakotomalaza & D. Ravelomanantsoa 2100* (G, MO, TAN).

24. Gaertnera masoalana C. M. Taylor, sp. nov. TYPE: Madagascar. Antsiranana: SAVA, Masaola Peninsula, 0–1 km NW of "Tamany Rabe Pierre" watershed of Anaovandrano River, 15°44′S, 50°13′E, 50 m, 16 Nov. 1996, *G. E. Schatz, J. Dransfield, S. Dransfield & R. Bernard 3683* (holotype, MO-6023166!; isotypes, K n. v., P n. v., TAN n. v.). Figure 5A–C.

Haec species a *Gaertnera phanerophlebia* Baker foliis plerumque domatiis praeditis, inflorescentia sessili usque pedunculata cymosa duplo vel triplo ramificante atque lobis calycinis 1.5–5 mm longis distinguitur.

Shrubs and small trees to 10 m tall, drying orangish brown to brown; branchlets 1.5–3.5 mm diam., quadrangular to a little flattened, hirtellous to glabrous. Leaves opposite; blades oblanceolate to narrowly elliptic, 7–13 × 1.5–5 cm, drying chartaceous to subcoriaceous and matte, adaxially glabrous, abaxially glabrous or hirtellous on midrib and sometimes also secondary veins, at base acute to cuneate, at apex acute to acuminate with tips 3–10 mm; secondary veins 9 to 12 pairs, abaxially prominent, usually with foveolate and sometimes also hirtellous domatia 0.2–0.5 mm diam., with tertiary venation not evident or sometimes weakly visible abaxially; petioles 6–18 mm, hirtellous to glabrous; stipules calyptrate, hirtellous to glabrous, drying membranaceous and reddish brown, deciduous via fragmentation, tube 10–22 mm, smooth or weakly ridged, with rounded to flat wings 0.5–1.5 mm wide encircling petioles and extending to base of tube, apex with 1 incision, triangular, with 2 to 4 linear lobes 2–4 mm. Inflorescences rather densely cymose, many-flowered (50+), terminal on principal branches, erect, densely hirtellous to glabrescent, sessile to pedunculate, peduncles to 2 cm; branched portion corymbiform, 3–7 × 4–7 cm, branched to 2 to 3 orders; bracts ligulate to narrowly oblanceolate, 5–10 mm; bracteoles ligulate, 3–8 mm. Flowers sessile, distylous, 5-merous; calyx cupuliform, 2–3 mm wide, externally strigillose to glabrous, internally glabrous, tube ca. 2 mm, lobes 3 to 5, ligulate, 1.5–5 mm, subequal to unequal; corolla in bud obtuse, at anthesis salverform, white, externally glabrous to sparsely pilosulous-puberulous, internally glabrous except densely villosulous in upper part of tube, tube 3.5–5 mm, cylindrical to slightly funnelform, ca. 1 mm diam. near middle, lobes triangular, 1–1.5 mm, at apex abaxially a little thickened, adaxially weakly hooked; anthers in long-styled form ca. 0.8 mm, partially exserted, in short-styled form ca. 1 mm, exserted; stigmas in long-styled form ca. 0.3 mm, exserted, in short-styled form ca. 1.2 mm, positioned in upper part of corolla tube. Drupes not seen.

Habitat, distribution, and phenology. *Gaertnera masoalana* is known from wet forests at 50–294 m in the provinces of Antsiranana (SAVA) and Toamasina (Analanjirofo and Atsinanana). It has been collected mainly or perhaps only on quartz outcrops. *Gaertnera masoalana* has been collected in flower from October through December and is not yet documented in fruit.

IUCN Red List category. *Gaertnera masoalana* is known only from three subpopulations in lowland humid forest, two of which are within the Masoala protected area. With a restricted geographic range size (EOO = 4794 km^2), expected decline of the subpopulation that is lacking protection at Maroseranana, and only three locations, *G. masoalana* is here considered to be Endangered [EN B1ab(iii)].

Discussion. *Gaertnera masoalana* is well documented in the area of the Masoala Peninsula, and the species epithet refers to this range. It can be recognized by the combination of its slender stems and leaves, deciduous calyptrate stipules, rather short, densely corymbiform inflorescences, calyx with generally ligulate lobes, and relatively short corollas. *Gaertnera masoalana* is similar in general aspect to *G. phanerophlebia*, which is found from northern through east-central Madagascar; *G. phanerophlebia* can be recognized by its leaves that lack domatia; subsessile, subcapitate to densely congested cymose inflorescences with the axes not evident; and larger corollas with tubes 9.5–17 mm long (for the contrasting characters of *G. masoalana*, see its description above). This new species is also similar to *G. velutina*, described later in this article and found widely through eastern Madagascar; *G. velutina* can be recognized by its tubular, generally persistent stipules, inflorescences with the flowers mixed sessile and pedicellate, and longer corollas with tubes 5–6 mm. Several specimens of *G. masoalana* were cited by Malcomber and Taylor (2009) as *G. obovata* var. *sphaerocarpa*, which is widely distributed in Madagascar; however, *G. obovata* var. *sphaerocarpa* can be separated by its calyx with the lobes only up to 1 mm long and usually shorter and distribution at generally higher elevations, 360–1876 m.

Paratypes. MADAGASCAR. **Antsiranana:** SAVA, Masoala Nat. Park, near Andranobe, 15°39′S, 49°57′E, *Moïse 4* (MO). **Toamasina:** Analanjirofo, Masoala Nat. Park, W coast, near Andranobe, 15°40′S, 49°57′E, *S. T. Malcomber 2813* (MO); Atsinanana, Brickaville, Maroseranana, N du village d'Andeka, 18°33′S, 48°51′E, *T. Andriamihajarivo, R. Razakamalala, J. L. Andriatiana & J. Samisy 703* (MO).

25. Gaertnera microphylla Capuron ex Malcomber & A. P. Davis, Monogr. Syst. Bot. Missouri Bot. Gard. 104: 390, figs. 2, 6. 2005. TYPE: Madagascar. Toamasina: Alaotra-Mangoro, 6.6 km SE of Andasibe, small ridge beside RN2 at base of Andriandavibe, 23 Nov. 1997, *S. T. Malcomber, A. Davis, D. Gower & J. Andriantiana 2925* (holotype, MO; isotypes, A, BR, G, K, LE, MAL, MAU, P, PRE, TEF, UPS, WAG).

Distribution and IUCN Red List category. *Gaertnera microphylla* is found in central eastern Madagascar at 790–1050 m in the province of Toamasina. Although this species is present in the protected areas of Analamazaotra-Périnet and Mantadia, it has an extremely restricted geographic range size (EOO ca. 100 km^2; AOO ca. 60 km^2) in subhumid forest only in the Périnet–Mantadia region. Given continuing decline outside of these protected areas due to habitat degradation and conversion and its only four known locations, *G. microphylla* is here considered to be Endangered [EN B1ab(iii)+2ab(iii)].

See Malcomber and Taylor (2009: 635–636) for a species description.

26. Gaertnera monstruosa Malcomber, Ann. Missouri Bot. Gard. 96(4): 636, fig. 12A–D. 2009. TYPE: Madagascar. Toamasina: Analanjirofo, 6.4 km W of Antanambe, Mananara Nat. Park, lowland rainforest, 180 m, 16 Nov. 1997, *S. T. Malcomber 2887* (holotype, MO; isotypes, BR, K, P, TEF, WAG).

Distribution and IUCN Red List category. *Gaertnera monstruosa* is found in northeastern Madagascar in the provinces of Toamasina and Fianarantsoa at 50–570 m. It is distributed in humid forest from west of Foulepointe at Analalava to northwest of Maroantsetra and is present in the protected areas of Ambatovaky, Makira, and Mananara-Nord as well as the conservation site Analalava. With a restricted geographic range size (EOO = 8396 km^2; AOO ca. 4000 km^2), expected continuing decline outside of protected areas due to habitat degradation and conversion, and only five known locations, *G. monstruosa* is here considered to be Vulnerable [VU B1ab(iii)].

See Malcomber and Taylor (2009: 636–637) for a species description.

27. Gaertnera nitida C. M. Taylor, sp. nov. TYPE: Madagascar. Antsiranana: DIANA, Presqu'île d'Ampasindava, forêt de Bongomihiravavy, 13°45′55″S, 48°03′08″E, 278 m, 28 Nov. 2007, *L. Nusbaumer 2585* (holotype, G!; isotype, MO-6306900!). Figure 7A, B.

Haec species a *Gaertnera obovata* var. *sphaerocarpa* (Baker) Malcomber et *G. macrostipula* Baker foliis crassis plerumque nitidis venatione subtiliter reticulata abaxialiter manifesta atque corolla breviore, etiam a hac stipulis tubularis distinguitur.

Shrubs to 10 m tall, drying greenish brown or brown; branchlets 3–5 mm diam., flattened, glabrous. Leaves opposite; blades obovate, oblanceolate, elliptic, or elliptic-obovate, 6–15 × 3.5–9 cm, drying chartaceous to subcoriaceous and shiny, glabrous on both surfaces, at base obtuse to cuneate, at apex obtuse to rounded or truncate and sometimes abruptly acuminate with tips 1–5 mm; secondary veins in 4 to 6 pairs, plane to thinly prominulous abaxially, with foveolate domatia 0.3–0.5 mm diam., with intersecondary and tertiary venation extensively reticulated and visible abaxially; petioles 10–30 mm, glabrous; stipules tubular, glabrous, drying papery and dark brown, generally persistent, tube 15–25 mm, smooth, wings absent or tardily developing, rounded, ca. 0.5 mm, encircling bases of petioles, apex with 1 or 2 incisions, with 2 triangular lobes 1–2 mm. Inflorescence rather congested to rather laxly cymose, many-flowered (50+), terminal on principal branches, erect, sparsely to densely pilosulous-puberulous, pedunculate; peduncle 0.8–3.5 cm; branched portion pyramidal to corymbiform, 3–16 × 6–14 cm, branched to 3 to 4 orders; bracts ovate to narrowly triangular, 2–35 mm; bracteoles ovate to triangular, 1–5 mm. Flowers sessile or subsessile, distylous, 5-merous; calyx cupuliform, 2.2–3 mm wide, internally and externally glabrous, tube 1.8–3 mm, truncate to lobed, lobes 5, broadly to narrowly triangular, 0.5–2 mm, subequal to unequal; corolla in bud obtuse to acute, at anthesis salverform, white, externally glabrous, internally densely barbate on upper part of tube and onto bases of lobes, tube 3–5 mm, cylindrical to funnelform, 1–1.5 mm diam. near middle, lobes ligulate, 2–3 mm, at apex abaxially smooth or a little thickened, adaxially hooked; anthers in long-styled form ca. 2 mm, partially exserted, in short-styled form ca. 1.5 mm, exserted; stigmas in long-styled form 1–1.2 mm, well exserted, in short-styled form ca. 1.2 mm, positioned in upper part of corolla tube. Immature drupes ovoid, 6–7 mm diam.; pyrenes 2, hemispherical, abaxially smooth.

Habitat, distribution, and phenology. *Gaertnera nitida* is known from subhumid to dry vegetation, often on sandy substrates at 50–350 m in northwestern Madagascar in the provinces of Antisranana (DIANA) and Mahajunga (Sofia). *Gaertnera nitida* has been collected in flower in August, September, October, and November and in fruit in February through April.

IUCN Red List category. *Gaertnera nitida* is present in the protected areas of Ankarafantsika and Manongarivo. With a restricted geographic range size (EOO = 13,133 km^2; AOO ca. 1200 km^2), expected continuing decline outside of protected areas due to habitat degradation and conversion, and 13 known locations, *G. nitida* is here considered to be Near Threatened (NT).

Discussion. *Gaertnera nitida* extends into the dryest habitats of any species of *Gaertnera*, and can be recognized by its stiff, generally shiny leaves with regularly developed domatia and the finely reticulated tertiary venation visible on the lower surface, persistent smooth stipule tubes, and rather short corollas. The species epithet refers to the leaves, which are often shiny on both upper and lower surfaces. *Gaertnera nitida* as circumscribed here includes some morphological variation in the length of the bracts, the shape and size of the bracteoles, and calyx form. The specimen *Malcomber & Rakotomalala 2594* and the type specimen have well-developed inflorescence bracts up to 20 mm long, relatively long bracteoles, and relatively long calyx lobes. Most of the other specimens studied have short bracts and bracteoles and a truncate to denticulate calyx, but several specimens are intermediate in form. For example, *Cheek 2190* has well-developed bracts with the largest ones 15–35 mm long, ovate bracteoles 1–2 mm long, and triangular calyx lobes 0.8–1 mm, while *Service Forestier 7680* has relatively short bracts and bracteoles but long calyx lobes ca. 0.8 mm long.

Gaertnera nitida was previously confused with *G. obovata* var. *sphaerocarpa*, which is found widely in Madagascar, but *G. obovata* var. *sphaerocarpa* differs in its thinner textured leaves with the lower surface not shiny, quickly caducous stipules, and habitat generally in humid forest predominantly above 800 m elevation (for the contrasting characters of *G. nitida*, see its description above). *Gaertnera nitida* was also previously confused with *G. macrostipula*, which is also found widely in Madagascar; *G. macrostipula* can be recognized by its tubular, usually inflated stipules, leaves that are not shiny and have the tertiary venation sparsely or not at all visible, and longer corollas with tubes 6.5–9 mm long. *Gaertnera nitida* is also similar to *G. sclerophylla* and *G. breviflora*; see the discussion of *G. sclerophylla* for the separation of

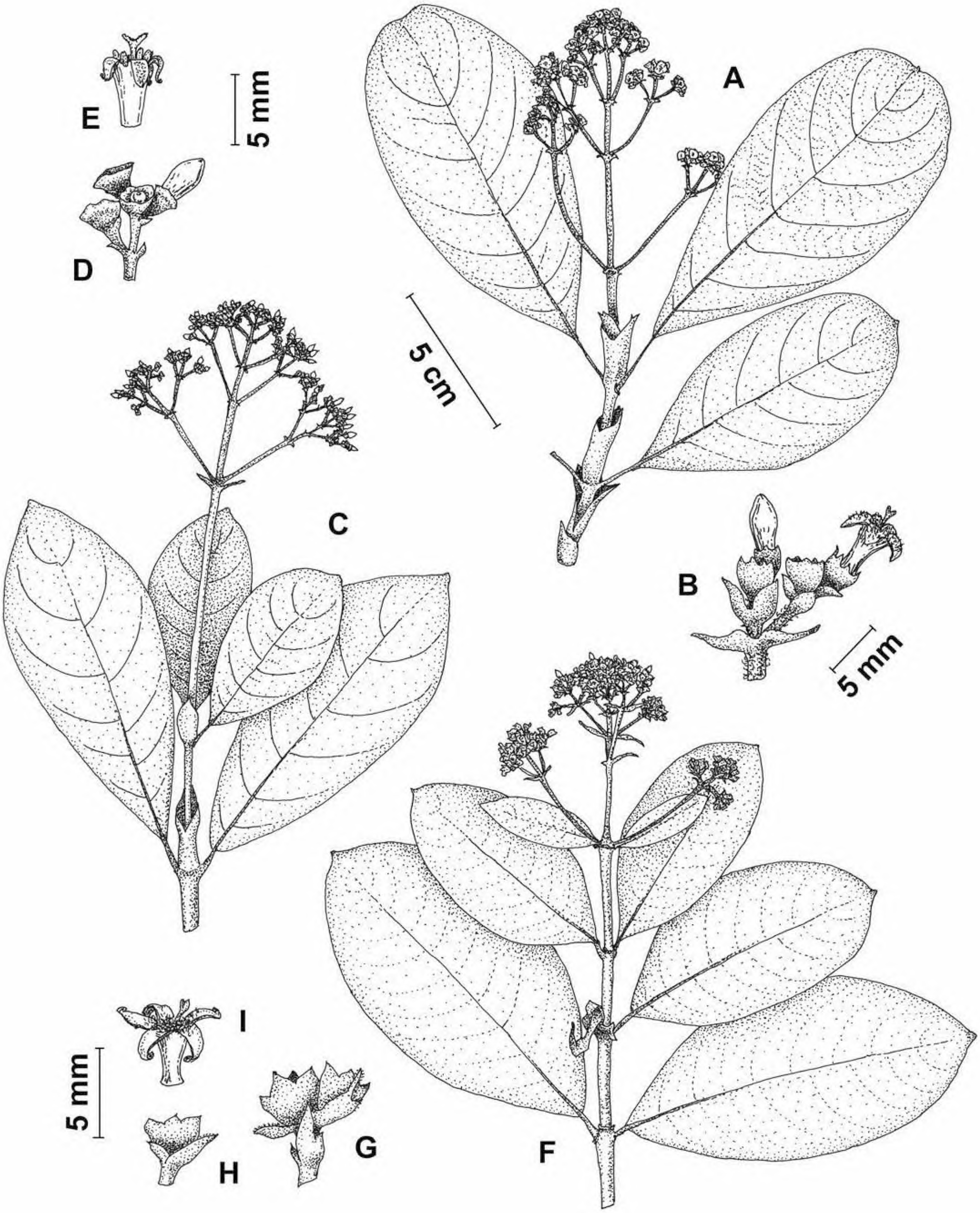

Figure 7. A, B. *Gaertnera nitida* C. M. Taylor. —A. Flowering branch; based on *S. Wohlhauser et al. 734* (MO). —B. Portion of inflorescence with one flower bud, one flower at anthesis, and two flowers from which corollas have fallen, based on *L. Gautier & P. Derlith 2514* (MO). C–E. *Gaertnera sclerophylla* C. M. Taylor; based on the type *G. McPherson & J. Rabenantoandro 18404* (MO). —C. Flowering branch. —D. Portion of inflorescence with one flower bud and three flowers from which corollas have fallen. —E. Corolla at anthesis, with style, dissected off flower. F–I. *Gaertnera xerophila* C. M. Taylor; based on the type *D. Rabehevitra et al. 410* (MO). —F. Flowering branch. —G. Portion of inflorescence with two flowers from which corollas have fallen. —H. Flower from which the corolla has been removed. —I. Corolla at anthesis, dissected off flower, together with style. A, C, F, to same 5-cm scale; G–I, to same 5-mm scale.

these and several other species found in littoral vegetation. *Gaertnera nitida* is also similar to *G. vernicosa*; for their separation see the discussion under *G. vernicosa*.

Paratypes. MADAGASCAR. **Antsiranana:** DIANA, sud d'Ambilobé, *R. Decary 14790* (MO); Montagne d'Ambato, 13°26′S, 48°33′E, *J. Kårehed, S. Razafimandimbison & H. Bremer 253* (MO, UPS), Ambilobe, Beramanja, Ankazomahitsy, Savoka à Ravinala, 13°28′S, 48°44′E, *R. Ludovic 26* (MO), Ampasindava, forêt de Bongomihiraravy, *L. Nusbaumer, P. Ranirison, M. C. Madiomanana, N. Y. Ammann, D. J. Tahinanarivony & R. Bernard 2733* (G, MO); Ambilobe, Beramanja, forêt de Kalabenonon, sur la chaine Galoko, 7 km SE d'Anketrabe, 13°38′S, 48°40′E, *J. Razafitsalama, Torze & E. Toninjama 1031* (K, MO), Ambilobe, Beramanja, Chaîne Galoka, Mont Galoka, Anketrabe-Belinta, 13°35′S, 48°43′E, *S. Wohlhauser, Tonga, M. S. Ravokatra, A. Lang, N. Manasse, C. Claude & G. Bocksberger 734* (MO); presqu'île d'Ampasindava, forêt de Andranomatavy, 13°40′13″E, 47°59′07″S, *M. Y. Ammann, M. C. Madiomanana & A. J. Tahinarivony 367* (K, G, MO); Ambanja, Ambaliha, Tsarabanja, forêt d'Ambohimirahavy, *R. Bernard, Louis, Patrick, Jacky, Cathy, Morgane, Ndrianary & Pierre 1204* (MO, TAN); Ambanja, Bemanevika, Bandrakorony, forêt de Bandrakorony, 13°45′35″S, 47°59′26″E, *R. Bernard et al. [no other collectors listed] 1242* (G, MO); forêt du côté Ouest de la grande rivière de Bandrakorony sur la Péninsula d'Ampasindava, 13°44′49″S, 47°59′36″E, *C. Rakotovao, Maevalignitry & Zazà 4165* (G, MO), *4267* (G, MO), Ambanja, village Beampongy, *Service Forestier de Madagascar 7680* (MO); Réserve Spéciale de Manongarivo, Besinkara, Ambalafary, 14°04′S, 48°17′E, 350 m, *L. Gautier & P. Derlith 2514* (K, G, MO), E of Ankarakmy Be Manongarivo Reserve Special, Bekolosy, 14°03′S, 48°17′E, *S. T. Malcomber & L. Rakotomalala 2594* (K, MO); Antanambao, contreforts occidentaux de la plaine du Sambirano, Maevatanana, 13°55′S, 48°30′E, *S. Wohlhauser & H. Andriamalaza 60225* (G, MO). **Mahajunga:** Sofia, Maromandia, Antsohihy, 22 km, 14°12′S, 48°08′E, *M. Cheek, A. Rakotozafy & Raharilala 2190* (K, MO); RN7, Marovoay, *Reserves Naturelles de Madagascar 6653RN* (MO).

28. Gaertnera obovata Baker, J. Bot. 20: 218. 1882. *Sykesia obovata* (Baker) Kuntze, Revis. Gen. Pl. 2: 425. 1891. TYPE: Madagascar. "Chiefly from Betsileo-land," *R. Baron 149* (holotype, K; isotype, P).

Distribution and IUCN Red List category. *Gaertnera obovata* is found from northwestern to eastern and southeastern Madagascar at 0–850 m, in the provinces of Mahajunga, Antsiranana, Toamasina, Fianarantsoa, and Toliara. With a large geographic range size (EOO = 358,800 km^2) and a presence in numerous protected areas (Analamazaotra-Perinet, Andohahela, Andringitra, Anjanaharibe-Sud, Betampona, Isalo, Ivohibe, Makira, Manongarivo, Mantadia, Marojejy, Masoala, Ranomafana, Tsaratanana, and Zahamena), *G. obovata* is here considered to be of Least Concern (LC).

Discussion. Two varieties of *Gaertnera obovata* were recognized by Malcomber and Taylor (2009: 639–641); see that work and couplet #40 of the Key to Species here for their distinction. Here *G. obovata* var. *obovata* is circumscribed following Malcomber and Taylor (2009), but *G. obovata* var. *sphaerocarpa* is circumscribed more narrowly. Several of the specimens included in *G. obovata* var. *sphaerocarpa* by Malcomber and Taylor (2009) are classified here into several newly described species, and accordingly a revised description is presented here.

28a. Gaertnera obovata Baker var. **obovata.**

Distribution and IUCN Red List category. This variety is found from northwestern to eastern and southeastern Madagascar at 10–2000 m, in the provinces of Mahajanga, Antsiranana, Toamasina, and Fianarantsoa. With a large geographic range size (EOO = 208,917 km^2) and a presence in numerous protected areas (Andohahela, Andringitra, Anjanaharibe-Sud, Ivohibe, Makira, Manongarivo, Mantadia, Marojejy, Masoala, Ranomafana, Tsaratanana, and Zahamena), *Gaertnera obovata* var. *obovata* is here considered to be of Least Concern (LC).

See Malcomber and Taylor (2009: 639–640) for a description of this variety.

28b. Gaertnera obovata var. **sphaerocarpa** (Baker) Malcomber, Ann. Missouri Bot. Gard. 96(4): 640, fig. 13G–L. 2009. *Gaertnera sphaerocarpa* Baker, J. Linn. Soc. Bot. 20: 208. 1883. *Sykesia sphaerocarpa* (Baker) Kuntze, Revis. Gen. Pl. 2: 425. 1891. TYPE: Madagascar. Central Madagascar, *R. Baron 1243* (lectotype, designated by Malcomber & Taylor [2009: 640], K; isotype, P).

Shrubs or small trees to 7 m tall, drying greenish brown; branchlets 2.5–5 mm diam., quadrangular, glabrous, sparsely hirtellous, or sparsely to densely pilosulous. Leaves opposite; blades obovate or oblanceolate, 6–23.5 × 1.8–9 cm, drying chartaceous and matte, glabrous throughout or abaxially sparsely hirtellous to densely pilosulous on principal veins, at base acute to cuneate, at apex obtuse to rounded or truncate and usually abruptly acuminate with tips 2–5 mm; secondary veins in 5 to 11 pairs, abaxially prominulous, with pilosulous domatia, with secondary, intersecondary, and tertiary venation generally visible abaxially; petioles 3–22 mm, glabrous or sparsely to densely hirtellous or pilosulous; stipules calyptrate, glabrous or sparsely hirtellous or pilosulous at least in in apical portion, drying membranaceous and dark brown to reddish brown, caducous, sometimes fragmenting, 8–35 mm, smooth, with wings reduced or usually flattened to rounded, 0.2–0.5 mm, enclosing bottom and sometimes also sides of petioles, apex with 1 slit, with 2 linear teeth 2–4 mm, densely pilosulous. Inflorescence somewhat congested to laxly cymose, many-flowered (30+), terminal on principal branches, erect to perhaps deflexed, sparsely to moderately pilosulous or puberulous often in patches, pedunculate; peduncles 1–4.5 cm; branched portion broadly pyramidal to rounded-corymbiform, 2–13 × 4–18 cm, branched to 3 to 5 orders; bracts triangular to narrowly triangular, 1.5–8 mm, or occasionally those subtending secondary and sometimes tertiary axes foliaceous; bracteoles ligulate to ovate, 1–2 mm; pedicels to 2 mm. Flowers sessile or sometimes mixed sessile and pedicellate, distylous, 5-merous; calyx cupuliform, 2–3 mm wide, glabrous to puberulous or pilosulous externally, internally glabrous or usually with puberulous to strigillose ring near middle or base, tube 1.5–2 mm, denticulate to dentate, teeth 5, triangular, 0.1–1 mm, equal or subequal; corolla obtuse to truncate in bud, at anthesis salverform, white often flushed with violet or pink, externally glabrous, internally glabrous except densely barbate in upper part of tube and throat, tube 4–8 mm, cylindrical to weakly funnelform, 1.2–2 mm diam. near middle, lobes narrowly triangular, 2–3 mm, at apex abaxially thickened, adaxially shortly hooked; anthers in short-styled form ca. 1.8 mm, exserted, in long-styled form 1.8–2.2 mm, exserted; stigmas in short-styled form 1–2 mm, included, positioned near middle of corolla tube, in long-styled form 0.8–1 mm, partially to fully through shortly exserted. Drupes subglobose, 6–7 mm diam., violet to blue-black or occasionally perhaps white; pyrenes 2, hemispherical, smooth abaxially.

Distribution and IUCN Red List category. *Gaertnera obovata* var. *sphaerocarpa* is found from northwestern to eastern and southeastern Madagascar at 0–1730 m, in the provinces of Antsiranana, Toamasina, Fianarantsoa, and Toliara. With a large geographic range size (EOO = 327,035 km^2) and a presence in numerous protected areas (Analamazaotra-Périnet, Andohahela, Andringitra, Anjanaharibe-Sud, Betampona, Isalo, Ivohibe, Makira, Manongarivo, Mantadia, Marojejy, Masoala, Ranomafana, Tsaratanana, and Zahamena), *G. obovata* var. *sphaerocarpa* is here considered to be of Least Concern (LC).

Discussion. See Malcomber and Taylor (2009: 640) for synonymy. This variety can be recognized by the combination of its thin-textured, caducous, calyptrate stipules; chartaceous, oblanceolate or obovate leaves with the secondary, intersecondary, and tertiary venation regularly visible and with pilosulous domatia regularly developed; cymose inflorescences with the flowers generally sessile in dichasia; rather small, generally white corollas; and fruits 6–7 mm in diameter. The fruits are generally violet to blue-black, but occasionally reportedly white at maturity. White mature fruits are uncommon in *Gaertnera* and this may be an error in observation; however, there are species of Rubiaceae with normally blue fruits that occasionally produce white or perhaps albino fruits (e.g., *Psychotria deflexa* DC., Taylor et al., 2004; *Gonzalagunia panamensis* (Cav.) K. Schum., Taylor, 2012) and *G. obovata* var. *sphaerocarpa* may be another. As circumscribed here this variety has a range in humid forest at and above 360 m elevation, predominantly above 800 m elevation. The illustration of *G. obovata* var. *sphaerocarpa* presented by Malcomber and Taylor (2009: 640, fig. 13G–L) depicts a specimen, *Malcomber 2916*, that is here included in the newly described species *G. sclerophylla*.

Gaertnera obovata var. *sphaerocarpa* is similar to several *Gaertnera* species that are found at lower elevations and in particular *G. guillotii*, which is found along nearly the entire east coast of Madagascar; *G. guillotii* can be recognized by its generally smaller elliptic-oblong to elliptic-oblanceolate leaves, 1.7–13.2 × 0.7–4.6 cm, with the tertiary venation generally not visible; generally smaller inflorescences, with the branched portion 0.6–7 × 0.8–6.2 cm; generally smaller corollas with tubes 3–5 mm long; generally smaller fruits, 4.5–5.5 mm in diameter; and distribution in littoral forests at 0–750 m elevation (for contrasting characters of *G. obovata* var. *sphaerocarpa*, see its description above). *Gaertnera obovata* var. *sphaerocarpa* is also similar to *G. arenaria*, which is widely distributed in Madagascar; however, *G. arenaria* can be recognized by its tubular stipules with four longitudinal ribs and larger corollas with tubes 10–16 mm long. *Gaertnera obovata* var. *sphaerocarpa* is also similar to *G. sclerophylla* and *G. xerophila*; their separation is outlined in the dicussion of *G. sclerophylla*.

Representative specimens. MADAGASCAR. **Antananarivo:** Analamanga, 5.7 km ESE of Anjozorobe, 18°23′55″S, 47°56′09″E, *S. T. Malcomber, A. P. Davis & D. Gower 2836* (MO, TEF). **Antsiranana:** SAVA, E of Andapa, Marojejy Nat. Reserve, near summit of Marojejy Est, 14°26′43″S, 49°44′11″E, *S. T. Malcomber 2776* (MO, P, TEF). **Fianarantsoa:** Haute Matsiatra, Ranomafana Nat. Park, Vohiparara, 21°14′25″S, 047°23′38″E, *S. T. Malcomber, A. P. Davis, D. Gower, J. Andriantiana & A. Kotozafy 2857* (MO, TEF). **Toamasina:** Alaotra-Mangoro, near Andasibe, Mantadia Nat. Park, 18°49′04″S, 048°25′59″E, *S. T. Malcomber, A. P. Davis, D. Gower, J. Andriantiana & A. Kotozafy 2917* (MO). **Toliara:** Anosy, Beampingaratra Massif, Maloto Valley, *J.-H. Humbert 6322* (MO, P).

29. Gaertnera pauciflora Malcomber & A. P. Davis, Monogr. Syst. Bot. Missouri Bot. Gard. 104: 392, figs. 5, 7. 2005. TYPE: Madagascar. Antsiranana: SAVA, E of Andapa, Marojejy Nat. Reserve, 19–20 Sep. 1997, *S. T. Malcomber 2781* (holotype, MO; isotypes, A, BR, G, K, LE, MAL, MAU, P, PRE, TEF, WAG).

Distribution and IUCN Red List category. *Gaertnera pauciflora* is found in northeastern and southeastern Madagascar, in the provinces of Antsiranana, Toamasina, and Fianarantsoa at 300–1600 m. It is widely distributed in humid to subhumid forest from Vondrozo to the Ankarongameloka forest NW of Doany. Although it is present in the protected areas of Makira and Marojejy, population decline is projected in populations outside of protected areas due to habitat degradation and conversion. With a geographic range size exceeding the threshold values for threatened status (EOO = 27,918 km^2; AOO ca. 15,000 km^2) and the possibility that several of the 10 currently known subpopulations may disappear in the future, *G. pauciflora* is here considered to be Near Threatened (NT).

See Malcomber and Taylor (2009: 642–643) for a species description.

30. Gaertnera phanerophlebia Baker, J. Linn. Soc., Bot. 21: 425. 1885. *Sykesia phanerophlebia* (Baker) Kuntze, Revis. Gen. Pl. 2: 425. 1891. TYPE: Madagascar. "Central Madagascar," *R. Baron 2982* (lectotype, designated by Malcomber & Taylor [2009: 643], K; isotypes, BM, P). Figure 3E, F.

Shrubs or small trees to 8 m tall, drying reddish brown; branchlets 2–3 mm diam., flattened to angled, glabrous or usually hirtellous to hirsute later becoming glabrescent, trichomes drying reddish brown. Leaves opposite; blades narrowly elliptic to elliptic-oblong, 3–12(14.5) × 1.4–3.5(4.5) cm, drying chartaceous and matte, adaxially glabrous except usually densely strigose or sericeous to hirsute on midrib, abaxially glabrous except usually densely sericeous, hirsute, or hirtellous on principal veins and densely ciliate on margins, at base rounded to truncate, at apex acute to shortly acuminate with tips 1–5 mm; secondary veins in 6 to 15 pairs, abaxially prominulous, without domatia, with tertiary veins not visible abaxially; petioles 2–10 mm, glabrous to densely hirtellous or hirsute; stipules calyptrate, glabrous to hirsute, drying membranceous and reddish brown, caducous or usually deciduous through fragmentation, 10–32 mm, smooth, with flattened ridges 0.2–0.5 mm wide developed below petioles and occasionally extending onto basal portion of stipule, apex usually with 1 incision, broadly triangular, 1–2 mm. Inflorescences capitate to congested cymose, many-flowered (40+), terminal on principal branches, erect, densely hirsute or hirtellous to glabrous, subsessile to pedunculate, peduncle to 0.5 cm; head or branched portion subglobose to corymbiform, 1.5–4 × 2–5 cm, unbranched or branched to 1 to 3 orders; bracts narrowly triangular, 6–10 mm; bracteoles triangular, 4–9 mm, usually fused to base of calyx or inserted shortly above base. Flowers subsessile to sessile, distylous, 5-merous; calyx cupuliform, 2–2.5 mm wide, externally villosulous or hirtellous to glabrous, internally glabrous, tube 2.5–3.5 mm, lobed, lobes 5, narrowly triangular, 2.5–6 mm, subequal or unequal with 1 or 2 lobes half as long as longest lobe; corolla in bud obtuse, at anthesis salverform, white to violet, externally glabrous to hirtellous in upper 1/2–3/4, internally puberulous to villosulous in upper half of tube and onto bases of lobes, tube 9–11.5 mm, cylindrical, 1–1.5 mm diam. near middle, lobes narrowly triangular, ca. 3 mm, at apex abaxially smooth, adaxially with short hook; anthers in long-styled form 2–2.5 mm, exserted, in short-styled form ca. 2 mm, included, positioned near middle of corolla tube; stigmas in long-styled form ca. 2 mm, exserted, in short-styled form ca. 2.5 mm, included, positioned just above middle of corolla tube. Drupes subglobose to ovoid, ca. 7 × 6 mm, mature color either green or unknown; pyrenes 2, hemispherical, smooth abaxially.

Distribution, habitat, and phenology. *Gaertnera phanerophlebia* is known from northern to east-central Madagascar in humid to subhumid forests at 33–1350 m, in the provinces of Antsiranana and Toamasina. *Gaertnera phanerophlebia* has been collected in flower in January and October through December and in fruit in March.

IUCN Red List category. With a large geographic range size (EOO = 74,561 km^2; AOO ca. 22,500 km^2) and its presence in numerous protected areas (Ambatovaky, Anjanaharibe-Sud, Betampona, Mangarivo, Marojejy, Masoala, and Zahamena), *Gaertnera phanerophlebia* is here considered to be of Least Concern (LC).

Discussion. As circumscribed previously this species included some plants here separated as *Gaertnera hirsuta*, as discussed in more detail under that species above. Accordingly a revised description and illustration (Fig. 3E, F) are presented here for *G. phanerophlebia*. The specimen illustrated by Malcomber and Taylor (2009: 623, fig. 11G–M) as *G. phanerophlebia* is here included in *G. hirsuta*. See Malcomber and Taylor (2009: 643–644) for synonymy, which is not altered by the revised circumscription of this species. Davis et al. (2011) added a synonym for *G. phanerophlebia*, *Mussaenda gerrardii* Homolle.

Gaertnera phanerophlebia has been confused with *G. hirsuta*, which is found in the area of the Masoala Peninsula; *G. hirsuta* can be separated by its generally larger leaves 11.5–22 × 2.2–6.2 cm with more numerous secondary veins, 14 to 30 pairs, and the tertiary venation well developed; larger corollas with the tube ca. 11 mm and the lobes ca. 5.5 mm; and grayish green drying color (for contrasting characters of *G. phanerophlebia*, see its description above). *Gaertnera phanerophlebia* is similar in general aspect and many details to *G. hispida*, which is found from northern Madagascar to the Bay of Antongil region; *G. hispida* can be separated by its congested to rather laxly cymose inflorescences, bracteoles that are reduced or lacking, calyx limb that is truncate or has lobes only to 1.5 mm long, stouter corolla tubes 1.5–3.5 mm in diameter, and apparently larger fruits, 8–14 mm long (however, the mature fruits of *G. phanerophlebia* are not well known). *Gaertnera phanerophlebia* is also similar to *Bertiera crinita* (A. Rich.) Wittle & A. P. Davis, and these are frequently confused in sched.; *B. crinita* is found in northeastern Madagascar and can be recognized by its narrowly triangular, interpetiolar, generally persistent stipules.

There is some variation in *Gaertnera phanerophlebia* in size or robustness of the leaves and the inflorescences, and the plants are found in a variety of habitats. However, the flowers of all of these specimens are similar. This species is usually characterized in its hirsute pubescence but occasional plants are glabrous (e.g., *McPherson & van der Werff 16360*). Several specimens have the styles persistent on the young fruits, and the field notes for some collections report that the fruits seemed to be aborting (e.g., *De Block et al. 1804*, *De Block 2057* both with long-styled flowers).

Representative specimens. MADAGASCAR. **Antsiranana:** DIANA, Ambodisakoano, 14°05′S, 48°20′E, *G. McPherson & H. van der Werff 16360* (MO, TAN). **Toamasina:** Analanjirofo, Île Sainte-Marie, *L.-H. Boivin 1780* (G-DC, MO, P).

31. Gaertnera phyllosepala Baker, J. Linn. Soc., Bot. 20: 207. 1883. *Sykesia phyllosepala* (Baker) Kuntze, Revis. Gen. Pl. 2: 425. 1891. TYPE: Madagascar. "Central Madagascar," *R. Baron 1920* (holotype, K; isotype, P).

Distribution and IUCN Red List category. *Gaertnera phyllosepala* is known from northeastern to southeastern Madagascar, in the provinces of Antsiranana, Toamasina, Fianarantsoa, and Toliara at 0–1200 m. With a large geographic range size (EOO = 92,101 km^2; AOO ca. 22,000 km^2) in humid to subhumid forest and a presence in numerous protected areas (Betampona, Mananara-Nord, Masoala, Ranomafana, and Zahamena), *G. phyllosepala* is here considered to be of Least Concern (LC).

See Malcomber and Taylor (2009: 644–646) for a species description and synonymy.

32. Gaertnera phyllostachya Baker, J. Linn. Soc., Bot. 21: 425. 1885. *Sykesia phyllostachya* (Baker) Kuntze, Revis. Gen. Pl. 2: 425. 1891. TYPE: Madagascar. s. loc., *R. Baron 2327* (lectotype, designated by Malcomber & Taylor [2009: 646], K).

Distribution and IUCN Red List category. *Gaertnera phyllostachys* is found in northeastern to southeastern Madagascar, in the provinces of Antsiranana, Toamasina, and Fianarantsoa at 100–1200 m. With a large geographic range size (EOO = 85,969 km^2; AOO ca. 26,600 km^2) in humid to subhumid forest and a presence in numerous protected areas (Ambatovaky, Analamazaotra-Périnet, Andringitra, Betampona, Masoala, Ranomafana, and Zahamena), *G. phyllostachys* is here considered to be of Least Concern (LC).

See Malcomber and Taylor (2009: 646–647) for a species description and synonymy.

33. Gaertnera rakotovaoana C. M. Taylor, sp. nov. TYPE: Madagascar. Antsiranana: SAVA, Andapa, Doany, à 10 km au SO d'Andranololo, Andramanalana, 14°23′S, 49°22′E, 1489 m, 28 Apr. 2006, *C. Rakotovao, D. Ravelonarivo, Rico, Landry & R. Razakamala 3101* (holotype, MO-6310162!; isotypes, P n. v., TAN n. v.). Figure 4D–F.

Haec species a *Gaertnera ianthina* Malcomber pubescentia pilosula hirtellave, foliorum venis secundariis paucioribus, bracteolis plerumque majoribus atque floribus albis distinguitur.

Shrubs to 6 m tall, drying brown to orange-brown; branchlets 3–5 mm diam., quadrangular, moderately to densely hirtellous to glabrescent. Leaves opposite; blades elliptic to oblong, 10.5–20.5 × 2–6.8 cm, drying papery to chartaceous and matte, adaxially glabrous, abaxially glabrous or hirtellous on midrib and sometimes secondary veins, at base cuneate to obtuse, at apex acuminate with tips 5–11 mm long; secondary veins in 10 or 11 pairs, prominulous abaxially, without or usually with a few foveolate domatia ca. 0.2 mm, with intersecondary and tertiary venation not or weakly visible abaxially; petioles 3–11 mm, hirtellous or pilosulous-hirtellous to glabrescent; stipules calyptrate, moderately to densely hirtellous, drying reddish brown and membranaceous to papery, caducous, 25–28 mm, smooth or weakly 2-ribbed, with flattened wings 0.5–1.5 mm wide encircling petioles, apex with 1 incision, with 4 narrowly triangular lobes ca. 3 mm, strigillose to hirtellous, often remaining closely grouped or perhaps fused. Inflorescences laxly cymose, many-flowered (50+), terminal on principal branches, apparently erect, moderately to densely pilosulous or hirtellous-pilosulous, pedunculate; peduncle 2–6 cm; branched portion pyramidal, 9–15 × 6.5–14 cm, branched to 3 to 4 orders; bracts narrowly ligulate or narrowly triangular, 3–18 mm, or often basalmost secondary axes ebracteate or with foliaceous bracts; bracteoles ligulate to narrowly triangular, 2–5 mm; pedicels 2–5 mm. Flowers mixed sessile and pedicellate, distylous, 5-merous; calyx cupuliform, 2.5–3 mm wide, externally pilosulous-hirtellous to puberulous, internally strigillose throughout, tube 1.5–2 mm, lobed, lobes 4 or 5, triangular, 0.5–1.2 mm; corolla in bud obtuse, at anthesis salverform, white, externally glabrous on tube and hirtellous-puberulous on lobes, internally barbate on upper part of tube and lobes, tube 7.5–10 mm, cylindrical, ca. 1.2 mm diam. near middle, lobes ligulate, 3–4 mm, at apex adaxially weakly hooked, abaxially thickened; anthers in short-styled form ca. 3 mm, partially exserted, in long-styled form ca. 2 mm, included, positioned near middle of corolla tube; stigmas in short-styled form ca. 0.5 mm, exserted, apparently positioned near anthers, in long-styled form 1.2–1.5 mm, exserted. Immature drupes subglobose, to 8 mm diam.; pyrenes apparently 2.

Habitat, distribution, and phenology. *Gaertnera rakotovaoana* is known from subhumid forest in northern Madagascar at 738–1489 m in the province of Antsiranana (SAVA region). *Gaertnera rakotovaoana* has been collected in flower in February and with immature fruits in May.

IUCN Red List category. *Gaertnera rakotovaoana* is known from only six collections from the northern mountains, with an extremely restricted geographic range size (EOO = 635 km^2; AOO ca. 350 km^2). It is currently not documented from any protected areas, and is therefore expected to suffer a considerable population reduction, greater than 80%, over the next three generations (generation length estimated to be ca. 15 years). Therefore, *G. rakotovaoana* is here considered to be Critically Endangered (CR A3c).

Discussion. *Gaertnera rakotovaoana* can be recognized by its combination of pilosulous-hirtellous pubescence on the stipules, petioles, and veins of the leaf undersides, calyptrate caducous stipules, moderately large elliptic-oblong leaves, robust lax inflorescences with the individual flowers or small groups of flowers well separated, and white corollas with tubes 7.5–9 mm. The flowers are interpreted as distylous based on the documentation by specimens of flowers with two different anther positions, but are unusual in apparently having the stigmas positioned very close to the anthers in both forms. This aspect of the flowers is not well preserved on the specimens studied, but is inferred from the lengths of the styles of those flowers. The specific epithet of this handsome species honors Charles Rakotovao, collector of most of the specimens of this species as well as numerous other excellent specimens that extensively document Madagascar's flora for science.

Gaertnera rakotovaoana is similar in general aspect to *G. ianthina*, which is found in northern and northeastern Madagascar; *G. ianthina* can be recognized by its densely strigose pubescence, leaves with more numerous secondary veins, 14 to 20 pairs, mostly shorter bracteoles, 0.5–2 mm long, and pink to purple corollas. *Gaertnera rakotovaoana* is also similar to *G. hirsuta*, which is found in the Bay of Antongil region; *G. hirsuta* can be recognized by its hirsute pubescence, leaves with more numerous secondary veins, in 14 to 30 pairs, subcapitate to congested cymose inflorescences with the branched portion 4–7 cm long, larger corollas with tubes at least 11 mm long, and habitat at lower elevations, 0–600 m.

Paratypes. MADAGASCAR. **Antsiranana:** SAVA, Andapa, Ambodivohitra, forêt humide de Tsaralanto située à 12 km au SO d'Anjialavabe et au N d'Anjialavehely, 14°14′S, 49°26′E, *C. Rakotovao, J. Ihasotra & J. Rabevazaha 2707* (MO, P, TAN); Andapa, Doany, à 10 km au SO d'Andranololo, Andramanalana, 14°22′S, 49°23′E, *C. Rakotovao, D. Ravelonarivo, Rico, Landry & R. Razakamala 3204* (MO), Andranomilolo, *R. Rakotovao, R. Razakamalaza, D. Ravelonarivo, Rambimison (Ambalamasay) & José (Ambalamanasay) [sic on label] 3414* (K, MO); Anjialavahely, Antsahabalihe à 10 km vol d'ouiseau au N d'Anjialava, *D. Ravelonarivo et al. [no collectors listed] 1616* (MO, TAN); Sambava, Bevontro, Tsaratanana, à ca. 10 km SW de Morafeno, 14°11′S, 49°19′E, *C. Rakotovao, R. Razakamalaza, D. Ravelonarivo & José (Ambalamansy) [sic on label] 3583* (MO); Vohemar, Andrafainkona, forêt de Maromaniry, à 5 km au N d'Amspisarahina, 13°39′S, 49°33′E, *O. Randriambololomamonfy, R. Razakamalala & Jaowind 391* (MO).

34. Gaertnera raphaelii Malcomber, Ann. Missouri Bot. Gard. 96(4): 649, fig. 4G–I. 2009. TYPE: Madagascar. Fianarantsoa: Vatovavy-Fitovinany, Ranomafana Nat. Park, 900 m, Nov. 1991, *S. T. Malcomber et al. 1018* (holotype, MO; isotypes, BR, G, TAN, WAG).

Distribution and IUCN Red List category. *Gaertnera raphaelii* is found in east-central to southeastern Madagascar at 200–1000 m in the provinces of Fianarantsoa and Toliara. It is distributed in humid to subhumid forest from Andohahela to the Sakaleona River. This species is present in the protected areas of Andohahela, Andringitra, Ivohibe, Midongy Sud, and Ranomafana. With a geographic range size in excess of the threatened status thresholds (EOO = 23,196 km^2; AOO ca. 8000 km^2) and 20 locations, *G. raphaelii* is here considered to be of Least Concern (LC).

See Malcomber amd Taylor (2009: 649–650) for a species description.

35. Gaertnera razakamalalana C. M. Taylor, sp. nov. TYPE: Madagascar. Toamasina: Analanjirofo, Station Forestière Tampolo, 9 km N of Fenerive, 17°17′S, 49°25′E, 10 m, 25 Nov. 1994, *G. E. Schatz, L. Raholivelo, V. Raharimalala & J. Randriamampionona 3604* (holotype, MO-5714880!; isotypes, K n. v., P n. v., TAN n. v.). Figure 2G–I.

Haec species a *Gaertnera macrostipula* Baker inflorescentiae pedunculo plerumque breviore ac parte ramosa pyramidali, corolla breviore atque calyce subtruncato usque denticulato, a *G. obovata* var. *sphaerocarpa* (Baker) Malcomber stipulis tubularibus plerumque persistentibus distinguitur.

Shrubs and small trees to 11 m tall, drying brown or grayish brown; branchlets 5–7 mm diam., quadrangular to somewhat flattened, glabrous. Leaves opposite; blades obovate to oblanceolate, 9.5–25 × 4–10.5 cm, drying subcoriaceous and matte, glabrous on both surfaces, at base acute to cuneate or weakly obtuse, at apex rounded to truncate or shallowly retuse and infrequently then abruptly acuminate with tips 1–1.5 mm; secondary veins 7 to 9 pairs, abaxially prominulous, without domatia or sometimes with pilosulous patches deeply embedded in vein axils, with intersecondary and tertiary venation generally not visible or sometimes sparsely weakly visible abaxially; petioles 10–30 mm, glabrous; stipules tubular, glabrous, drying membranaceous to chartaceous and reddish brown to dark brown, generally persistent, smooth, tube 6–12 mm, somewhat inflated, becoming marcescent on margins, wings flattened, 0.5–1 mm, encircling petioles, apex with 2 or 4 incisions sometimes extending to base of tube, with 4 triangular teeth ca. 1 mm, glabrous to strigillose, often each tooth with ridge extending from its base downward for 1/4–1/3 of length of stipule tube. Inflorescence laxly cymose, many-flowered (50+), terminal on principal branches, erect, moderately to densely puberulous, pedunculate; peduncle 2–5 cm; branched portion pyramidal, 11–19 × 10–26 cm, branched to 4 or 5 orders; bracts narrowly triangular, 1.5–5 mm, or those subtending secondary axes sometimes foliaceous; bracteoles ligulate to broadly triangular, 0.8–1 mm; pedicels to 1 mm. Flowers sessile to subsessile or shortly pedicellate, with biology unknown, 5-merous; calyx cupuliform, ca. 2 mm wide, externally puberulous to glabrous, internally glabrous, tube 1–1.2 mm, denticulate to subtruncate, teeth 5, triangular, up to 0.2 mm; corolla obtuse to rounded in bud, at anthesis salverform, white, externally glabrous, internally densely barbate in throat, tube ca. 3 mm, funnelform, ca. 1.2 mm diam. near middle, lobes triangular to ligulate, ca. 2 mm, at apex abaxially smooth or weakly thickened, adaxially shortly hooked; anthers in presumed long-styled form ca. 2 mm, partially exserted; stigmas in presumed long-styled form ca. 0.8 mm, exserted. Drupes subglobose to ellipsoid, 6–8 × 6–8 mm, mature color unknown; pyrenes 2, hemispherical, smooth abaxially.

Habitat, distribution, and phenology. *Gaertnera razakamalazana* is known from littoral forests at 0–150 m in the province of Toamasina (Analanjirofo), in east-central Madagascar. *Gaertnera razakamalalana* has been collected in flower in November and in fruit in January, February, April, and May.

IUCN Red List category. *Gaertnera razakamalazana* is known from littoral forest vegetation at only three locations: the Ambohidena forest on Île Sainte Marie (Nosy Boraha), the conservation site Pointe Larrée, and the Tampolo forestry station. With a very restricted geographic range size (EOO = 1600 km^2; AOO ca. 50 km^2) and an expected continuing decline outside of conservation areas due to forest degradation and clearing, *G. razakamalazana* is here considered to be Endangered [EN B1ab(iii)+2ab(iii)].

Discussion. *Gaertnera razakamalazana* can be recognized by its tubular, somewhat inflated, generally persistent stipules, robust leaves that are generally rounded to truncate at the apex, generally quite robust inflorescences with relatively small bracts and bracteoles, and relatively small flowers. The inflorescences are distinctive in their peduncles that are relatively short compared to the branched portion, with the peduncle typically equal to or shorter than the first internode (i.e., section) of the primary axis of the branched portion. The stipules are also distinctive in their somewhat inflated tubes that are usually marcescent along their margins and irregularly incised. The specific epithet of this robust species honors Richard Razakamalala, collector of several specimens of this species as well as numerous other excellent specimens that extensively document Madagascar's flora for science.

Gaertnera razakamalalana is similar in general aspect to *G. obovata* var. *sphaerocarpa*, which is widely distributed in Madagascar; *G. obovata* var. *sphaerocarpa* can be recognized by its spathaceous, generally caducous stipules, leaves with the tertiary venation regularly visible abaxially, longer corollas with tubes 4–8 mm long, and distribution at higher elevations, 360–1876 m (for contrasting characters of *G. razakamalala*, see its description above). *Gaertnera razakamalalana* is also similar to *G. macrostipula*, which is found widely in Madagascar and known from similar habitats; *G. macrostipula* can be recognized by its larger calyx, 2–3.5 mm wide, with well-developed lobes, 1–3.5 mm long, and larger corollas with tubes 6.5–9 mm long. *Gaertnera razakamalalana* is also similar to *G. macrobotrys*, another widely distributed species; *G. macrobotrys* can be recognized by its larger corollas with tubes 6.5–10 mm long and 1.5–3.5 mm in diameter and distribution at higher elevations, 400–1100 m. *Gaertnera razakamalalana* is also similar to *G. breviflora*, which is found in similar habitats in southeastern Madagascar; *G. breviflora* can be recognized by its leaves that are apically acute to obtuse or rounded and usually also shortly acuminate, with the tips 3–10 mm long, stipule tubes that are not inflated, and larger bracteoles 1–4.5 mm long.

Paratypes. MADAGASCAR. **Toamasina:** Analanjirofo, Île Sante Marie, Lokintsy, Sahasifotra, forêt littorale d'Ambohidena, 16°51′S, 49°57′E, *S. N. Andrianarivelo, D. Rabehevitra, R. Razakamalala & Poity 84* (MO), *G. McPherson, J. Rabenantoandro & R. Razakamalala 18886* (MO), *R. Rabevohitra, R. Razakamalala & Poity 5011* (MO); 10 km N Fenerive-Est, Station Forestière Tampolo, 17°17′S, 49°25′E, *P. De Block, J. Tosh & F. Rakotonasolo 1816* (BR, MO), *R. E. Gereau, P.-J. Rakotomalaza, C. Rasolomanana, T. Razafindrabeaza, S. Rapanarivo & F. Andriatsiferana 5712* (K, MO), *L. C. Raholivelo, B. Takotoninina & B. Rakotoandahy 77* (MO); Soanierana-Ivongo, Manompana, Pointe Larree, Tanambao Ambodimanga, forêt d'Andakibe, *L. Nikolov 1783* (MO), forêt d'Antanambao-Ambodimanga, 16°46′S, 49°42′–43′E, *R. Rabevohitra, J. Rabenantoandro & R. Razakamalala 4330* (MO), *R. Razakamalala, G. McPherson & J. Rabenantoandro 495* (K, MO).

36. Gaertnera robusta C. M. Taylor, sp. nov. TYPE: Madagascar. Fianarantsoa: Vatovavy-Fitovinany, Andranobetokana, Ampasimadinika, Marofototra-Mananjary, 20°50′S, 48°05′E, 450 m, 15–22 Jan. 1999, *F. Ratovoson & F. Randiantafika 13* (holotype, MO-5682745!; isotypes, P n. v., TAN n. v.). Figure 2A–C.

Haec species a *Gaertnera macrostipula* Baker stipularum costis bene evolutis, lobis calycinis brevioribus, corolla alba graciliore, pedunculo plerumque longiore atque inflorescentiae parte ramosa pyramidali ad anguste pyramidali distinguitur.

Shrubs and small trees to 11 m tall, drying brown or greenish brown; branchlets 6–9 mm diam., quadrangular, glabrous. Leaves opposite; blades obovate, 10–28 × 6–15 cm, drying chartaceous to subcoriaceous and matte, glabrous on both surfaces, at base acute to cuneate or occasionally obtuse, at apex rounded to truncate or obtuse and occasionally acuminate with deltate tips 3–6 mm; secondary veins 6 to 9 pairs, abaxially prominulous, without domatia or with few to several pilosulous domatia deeply embedded in vein axils, with intersecondary and tertiary venation not or weakly visible abaxially; petioles 8–30 mm glabrous; stipules tubular, glabrous, drying papery to chartaceous and brown, generally persistent, tube (6)10–20 mm, smooth in upper portion, with flattened wings 0.5–1 mm wide encircling petioles and extending onto stipule tube, then angled to middle of each interpetiolar side and extending 1/4–1/2 of length of tube, at apex with 2 or 4 slits, with 4 narrowly triangular lobes 1–2 mm. Inflorescences laxly cymose, many-flowered (50+), terminal on principal branches, erect, moderately to densely puberulous-pilosulous often in lines or patches, pedunculate; peduncle 6–15 cm; branched portion 8–18 × 6–26 cm, pyramidal to narrowly pyramidal, branched to 3 to 5 orders; bracts narrowly triangular, 3–22 mm, or sometimes foliaceous; bracteoles ovate, lanceolate, or ligulate, 2–5 mm; pedicels 1–3 mm. Flowers mixed sessile and pedicellate, distylous, 5-merous; calyx cupuliform, 2.5–3.5 mm wide, externally puberulous to glabrous, internally glabrous, tube 1.8–2.5 mm, regularly to irregularly lobed, lobes 5, triangular, 0.8–1.1 mm, subequal; corolla obtuse to rounded or subtruncate in bud, at anthesis salverform, white, externally glabrescent on tube and sparsely to densely puberulous on lobes, internally densely barbate in upper part of tube and onto lobes, tube 6–8 mm, cylindrical to funnelform, 1–1.2 mm diam. near middle, lobes narrowly triangular, 2.5–3 mm, at apex smooth abaxially, adaxially shortly hooked; anthers in long-styled form ca. 1.2 mm, partially exserted, in short-styled form not seen; stigmas in long-styled form 0.8–1 mm long, exserted, in short-styled form 1–1.2 mm, included, positioned in upper part of corolla tube. Drupes subglobose to ellipsoid, 5–6 × 6–8 mm, white becoming blue, blue-violet, blue-black, or black, sometimes with persistent calyx lobes apparently elongating, to 2 mm; pyrenes 2, hemispherical, smooth abaxially.

Habitat, distribution, and phenology. *Gaertnera robusta* is known from humid forests on sandy soils and brown soils at 5–450(–600) m in eastern Madagascar, in the provinces of Toamasina (Analanjirofo and Atsinanana) and Fianarantsoa (Atsimo-Atsinanana and Vatovavy-Fitovinany). *Gaertnera robusta* has been collected in flower in January, February, November, and December and in fruit in January, February, April, May, and November.

IUCN Red List category. *Gaertnera robusta* is present in the protected areas of Betampona and Zahamena and the conservation sites of Analalava and Mahabo, but subpopulations outside of protected areas are expected to experience continuing decline due to forest degradation and clearing. Within an EOO of 31,803 km^2, less than 2000 km^2 is actually occupied (AOO) and only 10 locations are known; thus, *G. robusta* is here considered to be Vulnerable [VU B2ab(iii)].

Discussion. *Gaertnera robusta* can be recognized by its combination of well-developed, generally persistent tubular stipules, thick-textured, medium-sized to rather large leaves with the apices generally broad to rounded and the tertiary venation mostly not visible, relatively large inflorescences with well-developed peduncles, shortly lobed calyx limbs, and slender white corollas. The species epithet refers to the rather large leaves and inflorescences. Several specimens report that the indigenous name is "sadodoka" (*Reserves Naturelles 2324*, *Service Agricoles 1077*) or "dodoka" (*Service Forestier 15327*).

Gaertnera robusta can be confused with *G. macrostipula*, which is widely distributed in Madagascar and found in similar habitats; *G. macrostipula* can be recognized by its generally funnelform and rather inflated stipules, inflorescences with the branched portion corymbiform-rounded and the peduncles shorter, 2.5–7 cm long, calyx limb with the lobes 1–3.5 mm long and generally with some lobes more than 1.5 mm long, and pink corollas with stouter tubes, 1.3–3.5 mm in diameter (for contrasting characters of *G. robusta*, see its description above). These two species apparently also differ somewhat in phenology, with *G. macrostipula* collected in flower in January through March and in August and *G. robusta* in November through Februrary. *Gaertnera robusta* is also similar to *G. breviflora*, which is found in southeastern Madagascar in similar habitats; *G. breviflora* can be recognized by its shorter corollas with tubes 2–3 mm long and smaller truncate to denticulate calyx limbs, with the tube 1–1.2 mm long and the teeth up to 0.3 mm long or occasionally with a single lobe 0.8–1.1 mm long. *Gaertnera robusta* is also similar to *G. arenaria*, which is widely distributed in Madagascar and found in similar habitats; *G. arenaria* can be recognized by its stipules with four well-developed longitudinal ribs and four lobes 2.5–5 mm long, calyx that is truncate or denticulate with the lobes up to 0.5 mm long, and larger corollas with tubes 10–16 mm long and 1.8–4.5 mm in diameter.

Paratypes. MADAGASCAR. s. loc., *Reserves Naturelles 64-RN* (K, MO, P); Prov. Betsimisaneka du Centre, *Anonymous 303* (MO, P). **Fianarantsoa:** Atsimo-Atsinanana, environs de Vondrozo, *J. Bosser 18700* (MO, P); Farafangana, Mahabo-Mananivo, Mahabo, 23°08′S, 47°43′E, *J. Rabenantoandro, G. McPherson & Ratiana 638* (K, MO). Vatovavy-Fitovinany, Belambo forest, 22°04′S, 47°56′E, *J. Tosh, P. De Block & F. Rakotonasolo 358* (BR, K, MO). **Toamasina:** Analanjirofo, Toamasine II, Anterina, Mitanoka, Reserve Naturelle Intégrale 3 Zahamena, 17°44′–46′S, 48°54′–49°01′E, *N. M. Andrianjafy, L. Randrianjanaka, S. Rakotonandrasana & B. Tandriamampvonjy 240* (MO), *L. M. Randrianjanaka & B. M. J. Arnaud 28* (K, MO); along Rte. 5 from Fenerive to Maroantsetra, *T. B. Croat 32549* (MO); ca. 5 km S of Fenerive along Rte. 5, *T. B. Croat 32604* (MO); Fenerive Est, Station Forestière Tampolo, 17°16′S, 49°25′E, *R. E. Gereau, P.-J. Rakotomalaza, C. Rasolomalana, T. Razafindrabeaza, S. Rapanarivo & F. Andriatsiferana 5730* (K, MO), *Service Agricoles 1077* (MO, P), *Service Forestier (P. Zarah) 15327* (K, MO, P), *Service Forestier 17917* (K, MO, P), *J. L. Zarucchi, E. Rakotobe, A. Randrianasolo & A. Pool 7393* (K, MO). Atsinanana: Distr. Tamatave, Rendrirendry, Reserve Naturelle Intégrale de Betampona, 17°55′S, 49°13′E, *M. Andrianarisata 102* (MO), *Reserves Naturelles (Rakotoniania) 2324* (MO, P); Foulpointe, Analalava Forest Reserve, 17°43′S, 49°27′E, *M. Briggs 196* (K, MO), *J. Tosh, P. De Block & R. Rakotonasolo 86* (BR, MO).

37. **Gaertnera rubra** C. M. Taylor, sp. nov. TYPE: Madagascar. Toamasina: Analanjirofo, Zahamena RNI, O de la rivière Iofika, NO de village Bongabe, Miarinarivo, Vavatenina, 17°43′S, 48°59′E, 600 m, 20 Oct. 1994, *L. M. Randrianjanaka 214* (holotype, MO-04975860!; isotypes, K n. v., P n. v., TAN n. v.). Figure 6C–E.

Haec species a *Gaertnera obovata* var. *sphaerocarpa* (Baker) Malcomber foliis plerumque majoribus, calyce longiore atque corolla violacea usque rubra rosea aurantiaca violacea vel alba tubo longiore distinguitur.

Shrubs or small trees to 5 m tall, drying dark brown; branchlets 5–10 mm diam., quadrangular to subterete, glabrous. Leaves opposite; blades oblanceolate to obovate, 14–33 × 4.5–11.5 cm, drying papery to chartaceous and matte, glabrous on both surfaces, at base acute to cuneate, at apex acuminate with deltate tips 5–10 mm; secondary veins 8 to 16 pairs, prominulous to prominent abaxially, without domatia or occasionally with irregular patches of pilosulous or hirsute pubescence along midrib and/or basal part of secondary veins, with intersecondary and some tertiary veins visible abaxially; petioles 10–40 mm, glabrous; stipules calyptrate, glabrous, drying membranaceous and dark brown, caducous or often fragmentating, 25–35 mm (or perhaps longer), apparently smooth, with flattened wings 1–2 mm wide encircling petioles, apex with 1 incision, complete apex not seen. Inflorescences cymose, many-flowered (40+), terminal on principal branches, erect, glabrous, sessile to pedunculate, peduncle to 10.5 cm; branched portion pyramidal, 3.5–10 × 5–14 cm, branched to 3 to 4 orders; bracts deltate, ligulate, ovate, or 3-lobed, 1–3 mm, sometimes becoming scarious, or bracts subtending basalmost secondary axes sometimes foliaceous; bracteoles triangular to ligulate, 1–2 mm; pedicels to 2 mm. Flowers mixed sessile, subsessile, and pedicellate, distylous, 5-merous; calyx cupuliform to funnelform, 3–3.5 mm wide, internally and externally glabrous, tube 2.5–3 mm, denticulate, teeth 5, triangular, to 0.5 mm; corolla in bud obtuse, at anthesis salverform, violet, red, pink, orange, or white, externally glabrous, internally densely villosulous in upper half of tube, tube 9–11 mm, cylindrical, ca. 1.2 mm diam. near middle, lobes narrowly triangular, ca. 4 mm, at apex smooth abaxially, adaxially with thickened hook; anthers in long-styled form ca. 3 mm, included, positioned in upper part of corolla tube, in short-styled form ca. 2.5 mm, shortly exserted; stigmas in long-styled form ca. 1 mm, exserted, in short-styled form ca. 1.5 mm, included, positioned in basal part of corolla tube. Immature drupes ovoid to subglobose, 8–9 mm; pyrenes 2, hemispherical, smooth abaxially.

Habitat, distribution, and phenology. *Gaertnera rubra* is known from humid to subhumid forests at 500–1040 m in eastern Madagascar in the province of Toamasina (Alaotra-Mangoro, Analanjirofo, and Atsinanana). *Gaertnera rubra* has been collected in flower in September and October and in fruit in January and December.

IUCN Red List category. *Gaertnera rubra* is present in the protected areas of Makira and Zahamena and the conservation site Vohibe, but subpopulations outside of protected areas are expected to experience continuing decline due to forest degradation and clearing. With a restricted geographic range size (EOO = 5937 km^2; AOO ca. 4600 km^2) and only seven locations, *G. rubra* is here considered Vulnerable [VU B1ab(iii)].

Discussion. *Gaertnera rubra* can be recognized by its combination of relatively large obovate or elliptic-obovate leaves, spathaceous stipules, inflorescences with relatively stout axes that are generally overtopped by the leaves, and white to usually pink, red, violet, or orange corollas with well-developed tubes. The species epithet refers to the red corolla color that is frequent in this species but unusual in *Gaertnera.*

Gaertnera rubra is similar to *G. obovata* var. *sphaerocarpa*, which is widely distributed in Madagascar; *G. obovata* var. *sphaerocarpa* can be separated by its generally smaller leaves, 6–23.5 × 1.8–9 cm, with generally fewer secondary veins, 5 to 11 pairs; shorter calyx, with the tube 1.5–2 mm long; and white to pink corollas with shorter tubes, 4–8 mm long (for contrasting characters of *G. rubra*, see its description above).

Paratypes. MADAGASCAR. **Toamasina:** Alaotra-Mangoro, Antsianaka, *Humblot 422* [additional penciled number under this, "*424*"] (K, MO, P); Analanjirofo, Vavatenina, Parc Nat. Zahamena, Rivière Sahemora, 17°38′S, 48°53′E, *N. M. Andrianjafy, R. Ratovoson, S. Takotondrasana, L. Randianjanaka, P. Manenjaka & Gonata 179* (K, MO); Maroantsetra, Rantage, Morafeno, village of Behovana, 15°48′S, 49°32′E, *P. Antilahimena & Landrice 2253* (MO); Maroantsetra, Ambinanitelo, Marovovovonana, near village of Ambatofotsy, Mangabe forest, 15°18′S, 49°29′E, *P. Antilahimena 2659* (MO); Maroantsetra, Antsirabesahatany, Anjiahely, 15°24′S, 49°26′E, *P. Antilahimena, Pascal & Ramarosahana 1486* (MO); W of Vavatenina, Réserve Naturelle Intégrale Zahamena, forest of Amboditamenaka, 17°44′S, 49°00′E, *S. T. Malcomber, B. Rasolondraibe, L. Randrianjanaka & J. Abraham 2553* (MO); en dehors du PN de Zahamena, *R. Rakotondrajaona 151* (MO); Atsinanana, Ambinanindrano II, Ambalabe, Vatomandry, NO du Toin'i Foara, 19°10′S, 48°35′E, *R. Ranaivojaona, A. Randrianasolo, A. Razanatsima, Pierrot, Dada & Naivo 977* (MO).

38. Gaertnera schatzii Malcomber, Ann. Missouri Bot. Gard. 96(4): 651, fig. 2. 2009. TYPE: Madagascar. Toamasina: Analanjirofo, Masoala Nat. Park, Antalvia, 15°47′S, 50°02′E, 13–16 Nov. 1989, *G. E. Schatz, J. Dranfield, S. Dransfield, D. DuPuy & B. DuPuy 2808* (holotype, MO; isotypes, K, P, TAN, WAG).

Distribution and IUCN Red List category. *Gaertnera schatzii* is found in northeastern Madagascar in the province of Toamasina at 0–380 m. It is known only from a single location wholly encompassed within the Masoala protected area at Antalavia. In the absence of population size information and with no decline projected within the conservation area, *G. schatzii* is here considered to be of Least Concern (LC). Although no decline is expected within the protected area at Antalavia, low (< 1000 mature individuals) population size information might reveal an intrinsic risk of extinction and therefore threatened status.

See Malcomber and Taylor (2009: 651–652) for species description.

39. Gaertnera sclerophylla C. M. Taylor, sp. nov. TYPE: Madagascar. Fianarantsoa: Atsimo-Atsinanana, S of Farafangana, near village of Mahabo, littoral forest on sand, 23°11′S, 47°42′E, 25 m, 11 Nov. 2001, *G. McPherson & J. Rabenantoandro 18404* (holotype, MO-5888592!; isotypes, K n. v., TEF n. v.). Figure 7C–E.

Haec species a *Gaertnera obovata* Baker var. *sphaerocarpa* (Baker) Malcomber foliis basi obtusis usque rotundatis domatiis nullis perpaucisve, venatione tertiaria non manifesta atque stipularum parte tubulari plerumque persistente distinguitur; etiam sylvas littorales ad altitudines 10–120 m habitat.

Shrubs and small trees to 12 m tall, drying greenish brown; branchlets 3–5 mm diam., quadrangular, glabrous. Leaves opposite; blades obovate or oblanceolate, 6.5–26 × 3–11 cm, drying chartaceous to subcoriaceous and matte to somewhat shiny, glabrous on both surfaces, at base rather abruptly obtuse to rounded, at apex obtuse, rounded, or truncate then sometimes with broad acuminate tips 1–3 mm; secondary veins 5 to 7 pairs, plane to thinly prominulous abaxially, without domatia or some leaves with a few weakly developed foveolate domatia, with secondary venation generally visible, intersecondary and tertiary venation not visible or weakly developed abaxially; petioles 6–30 mm, glabrous; stipules calyptrate, glabrous, drying papery and dark brown or reddish brown, usually fragmenting with tubular basal portion persisting on 1 to 5 apical nodes or occasionally fully deciduous, 15–25 mm, smooth, wings absent or sometimes tardily developing, rounded, ca. 0.5 mm wide, encircling only underside of petiole, apex with 1 or 2 incisions, with 2 triangular lobes 1–2 mm, puberulous to glabrous. Inflorescence laxly cymose, many-flowered (50+), terminal on principal branches, erect, moderately to densely puberulous to pilosulous, pedunculate; peduncle 3–8 cm; branched portion pyramidal, 6–14 × 5.5–15 cm, branched to 3 to 4 orders; bracts deltate to linear, 1–2 mm; bracteoles ligulate to triangular, 0.5–1 mm. Flowers sessile or subsessile, distylous, 5-merous; calyx cupuliform, 1.5–2 mm wide, glabrous externally, internally glabrous except with a strigillose to puberulous ring near base, tube 1–1.5 mm, subtruncate to denticulate, teeth 5, triangular, to 0.4 mm; corolla in bud obtuse to truncate, at anthesis salverform, white, externally glabrous, internally densely barbate in upper part of tube, tube 4–6 mm, cylindrical ca. 1 mm diam. near middle, lobes narrowly triangular, ca. 2 mm, at apex abaxially smooth, adaxially shortly thickened to hooked; anthers in short-styled form 1.5–1.8 mm, exserted, in long-styled form ca. 2 mm, partially exserted; stigmas in short-styled form ca. 1.8 mm, included, positioned in upper part of corolla tube, in long-styled form ca. 0.8 mm, exserted. Drupes subglobose, 7–10 mm diam., blue, blue-black, or perhaps white; pyrenes 2, hemispherical, smooth abaxially.

Habitat, distribution, and phenology. *Gaertnera sclerophylla* is known from littoral forest on sandy substrates and from humid forests on laterite at 10–30(–120) m in eastern and southeastern Madagascar, in the provinces of Toamasina (Atsinanana), Fianarantsoa (Atsimo-Atsinanana and Vitovavy-Fitovinany), and Toliara (Anosy). *Gaertnera sclerophylla* has been collected in flower in August and October through December, and in fruit January through April.

IUCN Red List category. *Gaertnera sclerophylla* is known from Fort Dauphin to Ambila-Lemaitso. Although it is present in the protected area of Manombo and the conservation sites of Mahabo, Petriky, and Sainte Luce, its subpopulations outside of conservation areas are expected to experience continuing decline due to forest degradation and clearing. With a restricted geographic range size (EOO = 8145 km^2; AOO < 500 km^2) and only seven locations, *G. sclerophylla* is here considered to be Vulnerable [VU B1ab(iii)+2ab(iii)].

Discussion. *Gaertnera sclerophylla* can be recognized by the combination of its firm-textured, calyptrate stipules that generally persist as a tube around the stem; stiff-textured leaves that are oblanceolate to obovate, not shiny, abruptly obtuse to rounded at the base, generally without domatia, and generally with the tertiary venation not visible; lax cymose inflorescences; rather small, generally white corollas; subtruncate to denticulate calyx limbs; and habitat in littoral forest, with most of the collection from 10 to 30 m elevation, and one (*Davis et al. 2150*) from higher, at 120 m. The species epithet refers to the tough-textured leaves. The stipules characteristically split for about a third of their length along one or two incisions, forming, respectively, one asymmetric apical portion or two broadly triangular apical portions. In some cases the stipules appear to be tubular, and this species is keyed as having both calyptrate and tubular stipules to facilitate its identification. Specimen notes report variously blue to blue-black or white as the mature color of the fruits; this variation is uncommon in species of Rubiaceae but not unknown; for more information see the discussion of *G. obovata* var. *sphaerocarpa*.

Gaertnera sclerophylla is similar to *G. obovata* var. *sphaerocarpa*, which is widely distributed in Madagascar; *G. obovata* var. *sphaerocarpa* can be recognized by its usually thin-textured caducous stipules and generally thinner-textured, chartaceous leaves that are acute to cuneate at the base and have regularly developed domatia and the tertiary venation generally regularly visible (for contrasting characters of *G. sclerophylla*, see its description above). These two species are not completely separable by flower characters, but in addition to the differences in their leaves and stipules they are found in different habitats with *G. obovata* var. *sphaerocarpa* known from humid forests at 360 m and above.

Several morphologically similar species of *Gaertnera* with calyptrate stipules are known from littoral forests. Among these, *G. xerophila* (described later in this article) is found in east-central Madagascar and can be recognized by its thick-textured, subcoriaceous to coriaceous leaves with the venation generally not visible, calyx limb with lobes up to 1.2 mm long, and smaller corollas with tubes ca. 2.5 mm long. *Gaertnera guillotii* is found along nearly the entire east coast of Madagascar, and can be recognized by its somewhat smaller leaves, 1.7–13.2 × 0.7–4.6 cm, with regularly developed domatia and the tertiary venation generally not visible, generally smaller inflorescences with the branched portion 0.6–7 × 0.8–6.2 cm, and caducous stipules with four longitudinal ridges on the tubular portions. Some other similar species are also found in littoral forests but differ from the previously mentioned species in having tubular stipules. Among these, *G. nitida* is found in northwestern Madagascar, and can be recognized by its generally shiny leaves with the tertiary venation finely reticulated and visible although plane and generally regularly developed domatia. *Gaertnera macrostipula* is widely distributed in Madagascar and can be recognized by its well-developed persistent stipules with the tube often inflated, generally covering most or all of the internode above it, and becoming marcescent along the margins; generally larger flowers with corolla tubes 6.5–9 mm long; and calyx limbs with short to well-developed lobes 0.5–3.5 mm long. *Gaertnera breviflora* is found in southeastern Madagascar and can be recognized by its relatively small corollas, with the tube 2.5–3 mm long.

Paratypes. MADAGASCAR. **Fianarantsoa:** Atsimo-Atsinanana, Farafangana, Rés. Spec. Manombo, 23°01′–02′S, 47°43′–44′E, *A. P. Davis, F. Rakotonasolo & P. De Block 2150* (K, MO), *J. Rabenantoandro, G. McPherson & Gervais 772* (MO); Farafangana, Mahabo, 23°11′S, 47°42′E, *R. Ludovic & J. Emilson 968* (MO, TAN), *R. Razakamalala & D. Rabehevitra 704* (K, MO). **Toamasina:** Atsinanana, Ambila-Lemaitso, 18°53′S, 49°08′E, *Boiteau 490* (MO), *A. J. M. Leeuwenberg 13794* (K, MO), *S. T. Malcomber, A. Davis, D. Gower & J. Andriantiana 2914* (MO), *2916* (MO); Mahanoro, Ambodibonara, Ambalavontaka, forêt d'Antalamalotra (Antaimby Kely), 20°23′S, 48°33′E, *R. Ranaivojaona, R. Razakamalala & G. Paul 850* (K, MO); 4 km S Vatomandry, 19°24′S, 048°57′E, *J. Tosh, P. De Block & F. Rakotonasolo 66* (K, MO); Vatovavy-Fitovinany, Mahanoro, Ambodibonara, Ambalavontaka, forêt d'Antaimby, 20°22′S, 48°34′E, *R. Ranaivojaona, R. Razakamalala, Z. Rogers & P. Seth 637* (MO). **Toliara:** Anosy, St. Luce, along Rte. Nationale 13, 24°46′S, 47°09′E, *P. De Block, F. Rakotonasolo, Randriamboavonjy, S. Dessein & Leyman 649* (MO); Sainte Luce, Fort-Dauphin, forêts littorales, 24°46′S, 47°10′E, *L. Faliniaina, J. Rabenantoandro & E. Ramisy 35* (MO); N Fort Dauphin (Tôlañaro), near Ste. Luce (Manofiafy), 24°47′S, 47°10′E, *G. McPherson, N. Dumetz & R. Rabevohitra 14223* (K, MO).

40. Gaertnera velutina C. M. Taylor, sp. nov. TYPE: Madagascar. Fianarantsoa: Haute Matsiatra, Ranomafana Nat. Park, Vohiparara, 21°14′S, 47°24′E, 1100–1200 m, 2 Nov. 1997, *S. T. Malcomber, A. P. Davis, D. Gower, J. Andriantiana & A. Kotozafy 2863* (holotype, MO-5899033!; isotypes, P n. v., TAN n. v.). Figure 8D–G.

Haec species a *Gaertnera phanerophlebia* Baker stipulis tubularibus lobis calycinis atque corollis omnibus brevioribus distinguitur.

Shrubs and small trees to 8 m tall, drying brown or reddish brown; branchlets 3–5 mm diam., flattened, densely hirtellous to tomentulose with trichomes drying reddish brown, sometimes becoming glabrescent. Leaves opposite; blades oblanceolate to elliptic-oblanceolate or elliptic-oblong, 6.5–14 × 2.5–6.5 cm, drying chartaceous to subcoriaceous and matte, adaxially glabrous, abaxially densely hirtellous to tomentulose on midrib to throughout, at base acute to cuneate, obtuse, or infrequently rounded, at apex obtuse to acuminate with tips 2–8 mm; secondary veins 7 to 10 pairs, abaxially prominent, without domatia, with higher-order venation hardly or not visible abaxially; petioles 4–15 mm, hirtellous to

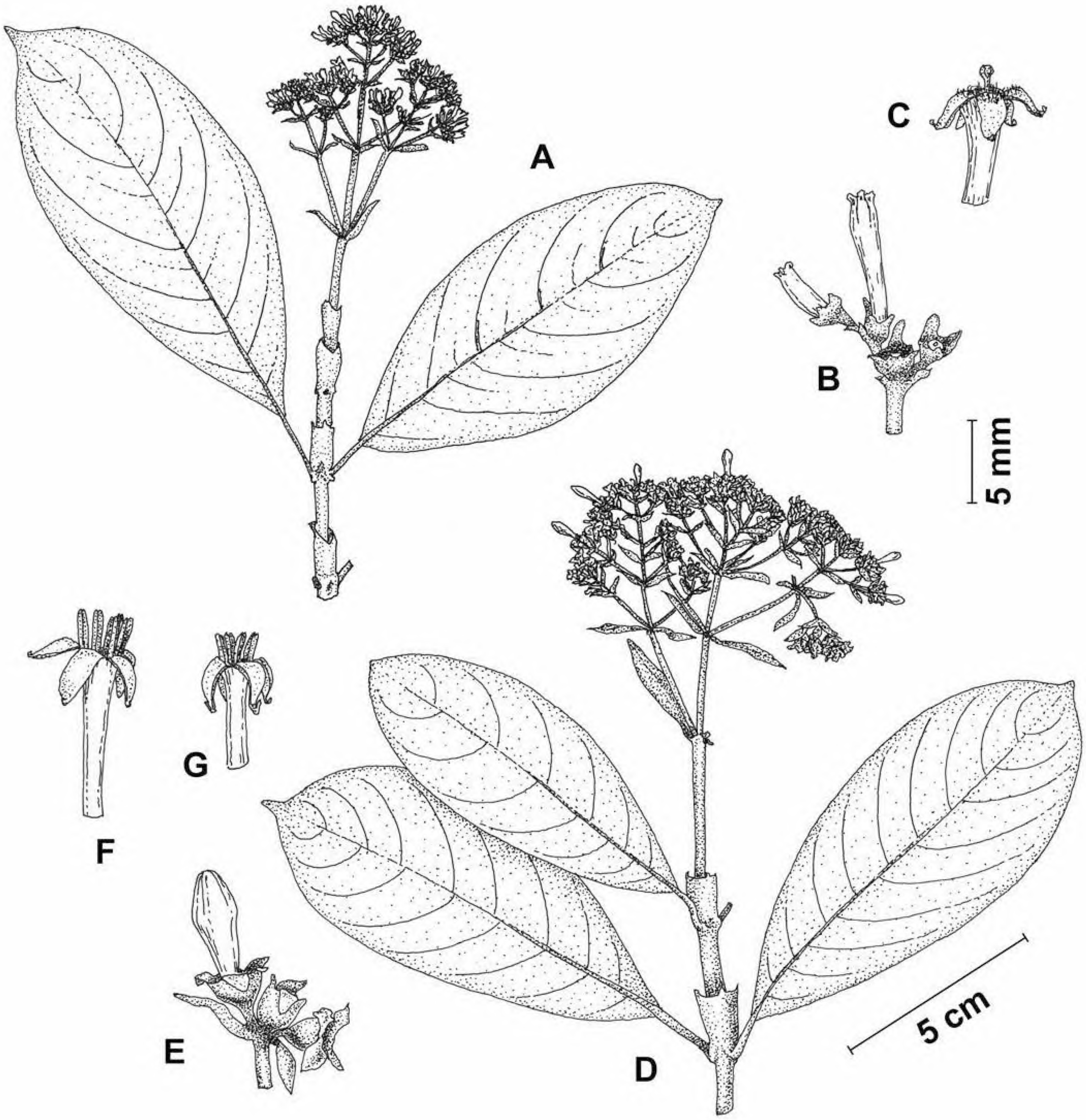

Figure 8. A–C. *Gaertnera vernicosa* C. M. Taylor; based on *R. Ranaivojoana et al. 959* (MO). —A. Flowering branch. —B. Portion of inflorescence with two flower buds and two flowers from which corollas have fallen. —C. Corolla at anthesis, with style, dissected off flower. D–G. *Gaertnera velutina* C. M. Taylor. —D. Flowering branch. —E. Portion of inflorescence, with one flower bud and two flowers from which corollas have fallen. —F. Corolla, dissected off flower, with relatively longer tube; based on *P. De Block 1751* (MO). —G. Corolla, dissected off flower, with relatively shorter tube. D, E, G based on *B. Lewis et al. 880* (MO). A, D, to same 5-cm scale; B, C, E–G, to same 5-mm scale.

tomentulose; stipules tubular, densely strigillose to tomentulose, drying papery and brown, persistent on 2 to 5 apical nodes or sometimes tubular portion dehiscing at base but remaining around stem, tube 6–16 mm, with wings ca. 1 mm wide encircling petioles and uniting just above base of tube, at apex generally not split, subtruncate to acute, with lobes 4, narrowly triangular to linear, 1–4 mm. Inflorescences rather laxly cymose, many-flowered (40+), terminal on principal branches, erect, densely hirtellous to strigillose, pedunculate; peduncles 2–6 cm; branched portion corymbiform, 4–10 × 5.5–11 cm, branched to 3 or 4 orders; bracts narrowly elliptic to narrowly triangular, 3–25 mm; bracteoles triangular to lanceolate, 1–7 mm, inserted below or often at base of calyx and sometimes fused to it; pedicels to 1 mm. Flowers mixed subsessile and pedicellate, distylous, 5-merous; calyx cupuliform, 2.5–3.5 mm wide, externally densely strigillose or tomentulose-strigillose, internally densely strigillose in upper part and glabrous in lower part, tube 2–3 mm, lobed, lobes 5, triangular, 1.5–3 mm, equal to somewhat unequal; corolla in bud obtuse, at anthesis salverform, white or sometimes pink, externally sparsely to densely strigillose-puberulous, internally glabrous except with pilosulous ring in upper part of tube, tube 5.5–8(10) mm, cylindrical, 1.2–1.5 mm diam. near middle, lobes narrowly triangular, 2–3 mm, at apex abaxially smooth, adaxially shortly hooked; anthers in short-styled form ca. 2 mm, included, positioned in upper part of corolla tube, in long-styled form ca. 2 mm, partially exserted; stigmas in short-styled form ca. 2 mm, included, positioned near middle of corolla tube, in long-styled form ca. 2 mm, linear, positioned in mouth of corolla tube. Immature drupes ovoid, ca. 5 mm diam.; pyrenes 2, hemispherical, abaxially smooth.

Habitat, distribution, and phenology. *Gaertnera velutina* is known from subhumid forests at (250–) 750–1400 m in eastern Madagascar, in the provinces of Finarantsoa (Haute Matsiatra, Ihorombe, and Vatovavy-Fitovinany), and Toamasina (Atsinanana). *Gaertnera velutina* has been collected in flower in August through December and in young fruit in January.

IUCN Red List category. *Gaertnera velutina* is found in the protected areas of Andringitra and Ranomafana. With a restricted geographic range size (EOO = 3625 km^2; AOO ca. 1850 km^2), an expected decline of subpopulations outside of protected areas due to habitat degradation and conversion, and only eight known locations, *G. velutina* is here considered to be Vulnerable [VU B1ab(iii)+2ab(iii)].

Discussion. *Gaertnera velutina* is characteristically evenly and shortly pubescent on the stems, stipules, and leaf undersurfaces, giving the plants a velvety appearance; the species epithet refers to this appearance. This new species is generally similar in overall aspect and pubescence to *G. phanerophlebia*, which is found in northern and northeastern Madagascar, in particular the leaves with the higher-order venation mostly not visible are similar in both species; however, *G. phanerophlebia* can be separated by its calyptrate stipules, densely congested to subcapitate inflorescences, usually longer calyx lobes 2–14 mm long, and larger corollas with tubes 9.5–17 mm long (for contrasting characters of *G. velutina*, see its description above). *Gaertnera velutina* is also similar to *G. macrostipula*, which is widely distributed in Madagascar; *G. macrostipula* can be recognized by its generally larger stipules, 12–35 mm long, that are mostly long enough to largely or completely cover the stem up to the next higher node and are irregular along the margins. *Gaertnera velutina* is also similar to *G. hispida*, *G. hirsuta*, and *G. obovata* var. *sphaerocarpa*, one or more of which can be found in most humid vegetation regions of Madagascar; these can all be recognized by their calyptrate stipules.

The specimen *De Block et al. 1751* was collected in a different part of the country from the other specimens included here, at a lower elevation, and in flower a little later in the season, and it may also differ from the others in its slightly longer corolla tubes, ca. 10 mm long (Fig. 8F). Otherwise this specimen cannot be separated morphologically from the remaining specimens included here in *G. velutina*. Few mature corollas have been collected in total, so the range of variation in corolla size in *G. velutina* from higher elevations may be incompletely known.

Paratypes. MADAGASCAR. **Fianarantsoa:** Haute-Masiatra, Ranomafana Natl. Park, Vohiparara, 21°14′S, 47°24′E, *S. T. Malcomber, A. Davis, D. Gower, J. Andriantiana & A. Kotozafy 2861* (K, MO), 21°14′S, 47°22′E, *S. T. Malcomber, A. Davis, D. Gower, J. Andriantiana & A. Kotozafy 2871* (MO), *S. T. Malcomber, A. Davis, D. Gower, J. Andriantiana & A. Kotozafy 2872* (MO); Ifanadiana, Ranomafana, Ranomena, Ampandriambazaha, 21°13′S, 47°26′E, *F. Rakotonasolo RNF 848* (BR, K, MO, TAN); Ihorombe, haute vallée de la Rienana (bassin du Matitanana), 22°15′S, 47°09′E, *H. Humbert 3450* (MO, P); ca. 43 km S of Ambalavao, Andringitra Reserve, jct. of Sahanivoraky & Sahavatoy rivers, 22°14′S, 47°00′E, *B. Lewis, J. Raharimalala, G. Rahajasoa, M. Randiambololona & J. McDonagh 880* (K, MO), ca. 40 km S of Ambalavo, Andringitra Reserve, along tributary of Sahavatoy River, 22°13′S, 46°58′E, *B. Lewis, J. Raharilala, P. J. Rakotomalala, M. Andrianarisata & J. McDonagh 958* (MO); Rés. Nat. Int. no. 5 Andringitra, Ivongo, Ambahatsy, 22°14′S, 47°00′E, *C. Rakotovao, M. Zjhra, J. Hutcheon & J.-B. Razafindrabe 83* (K, MO), *J. B. Razafindrabe, C. Rakotovao, M. Zhjra & J. Hutcheon 120* (MO); Andringitra, au NO d'Ambarongy, *C. Rakotovao 224* (MO); Vatovavy-Fitovinany, entre Fianarantsoa & Ranomafana, 38 km après Fianarantsoa, 21°16′S, 47°21′E, *P. De Block, S. Dessein, F. Rakotonasolo & Randiamboavonjy 621* (BR, MO); Massif d'Andrambovato, Tolongoina, Ikongo, 21°31′S, 47°26′E, *S. G. Razafimandimbison 342* (MO); Fanadiana, Parc Nat. Ranomafana (Miaranony), 21°08′S, 47°37′S, *R. Razakamalala, L. Andriamahefarivo & A. Kotozafy 239* (MO); Ranomafana, 19°06′S, 48°42′E, *H. van der Werff, S. T. Malcomber, B. Gray & S. Rapanarivo 12663* (K, MO). **Toamasina:** Atsinanana, PK 83 on rd. Moramanga–Brickaville, 18°58′S, 48°47′E, *De Block, J. Tosh & F. Rakotonasolo 1751* (BR, MO).

41. Gaertnera vernicosa C. M. Taylor, sp. nov. TYPE: Madagascar. Toamasina: Atsinanana, Vatomandry, Ambalabe, W of Vakoanina Toby, trail to Sahamahirana River, 19°10′S, 48°35′E, 638 m, 21 Nov. 2004, *A. Randrianasolo, R. Ranaivojaona & A. Razanatsima 893* (holotype, MO-5901079!; isotypes, P n. v., TAN n. v.). Figure 8A–C.

Haec species a *Gaertnera nitida* C. M. Taylor stipularum alis petiolum circumcinctis, lobis calycinis insigniter inaequalibus atque corolla longiore lobis abaxialiter incrassatis distinguitur.

Shrubs and small trees to 7 m tall, drying dark brown; branchlets 2–5 mm diam., quadrangular, glabrous. Leaves opposite; blades elliptic, elliptic-oblong, or elliptic-obovate, 9–18 × 3–6 cm, drying chartaceous to subcoriaceous and generally shiny, glabrous on both surfaces, at base acute to obtuse or rounded, at apex obtuse to truncate and usually also with acuminate tips 2–6 mm; secondary veins 5 to 9 pairs, abaxially prominulous, usually with small foveolate domatia, with intersecondary and tertiary venation extensively reticulated, visible, and prominulous abaxially; petioles 6–15 mm, glabrous; stipules tubular, glabrous, drying chartaceous and dark brown, persistent or sometimes deciduous, tube 9–16 mm, with flattened wings 0.5–1 mm wide, encircling petioles and extending as ridges 1/4–1/2 of length of tube, apex with 1 or 2 incisions, broadly triangular, with 2 linear lobes ca. 1 mm. Inflorescences congested to somewhat laxly cymose, many-flowered (40+), erect, terminal on principal branches, moderately to densely pilosulous-puberulous, pedunculate; peduncle 0.8–5.5 cm; branched portion broadly pyramidal, 4–7 × 6–6.5 cm, branched to 3 or 4 orders; bracts ovate to narrowly triangular, 2–17 mm; bracteoles ligulate to triangular, 1–4 mm; pedicels to 2 mm. Flowers mixed sessile, subsessile and shortly pedicellate, distylous, 5-merous; calyx cup-shaped, 2–3 mm wide, externally glabrous, internally puberulous, tube 1.5–2 mm, lobed, lobes 5, triangular, 0.5–3 mm, subequal or usually unequal by up to 300%; corolla in bud truncate and knobbed at apex, at anthesis salverform, white, externally glabrous, internally barbate from upper part of tube onto lobes, tube 6–7 mm, cylindrical to weakly funnelform, 1.1–2 mm diam. at middle, lobes ligulate-triangular, 2–2.5 mm, at apex abaxially with rounded to sublingulate thickening 0.2–0.3 mm near apex, adaxially shortly hooked; anthers in long-styled form ca. 2 mm, partially exserted, in short-styled form ca. 2 mm, exserted; stigmas in long-styled form ca. 0.8 mm, exserted, in short-styled form not seen. Drupes not seen.

Habitat, distribution, and phenology. *Gaertnera vernicosa* is known from humid to subhumid forest at 536–1100 m in northeastern to east-central Madagascar, in the provinces of Antsiranana (SAVA) and Toamasina (Alaotra-Mangoro and Atsinanana). *Gaertnera vernicosa* has been collected in flower in November and has not been documented in fruit.

IUCN Red List category. *Gaertnera vernicosa* is known from only five collections from Ambalabe to south of Marojejy. Although it is present in the conservation site of Vohibe, its subpopulations outside of this conservation area are expected to experience continuing decline due to forest degradation and clearing. With a restricted geographic range size (EOO = 8427 km^2; AOO ca. 7000 km^2) and only four locations, *G. vernicosa* is here considered to be Vulnerable [VU B1ab(iii)].

Discussion. *Gaertnera vernicosa* can be recognized by the combination of its tubular stipules with the petiolar wings extending onto their lower portions, stiff-textured leaves that are generally shiny on both surfaces and have the extensively reticulated tertiary venation prominulous below, cymose inflorescences, calyx limbs with the lobes usually markedly unequal, and moderately sized corollas with the lobes markedly thickened abaxially near the tip, giving the flower buds a truncate and knobbed apical profile. The shiny leaves often appear varnished on dried specimens; the species epithet refers to this feature. *Gaertnera vernicosa* is similar in particular in its shiny tough leaves to *G. nitida*, which is found in northwestern Madagascar; *G. nitida* can be recognized by its leaves with the tertiary venation plane on the lower surface, calyptrate stipules, and corollas with the lobes not much thickened abaxially and consequently the flower buds acute in outline (for contrasting characters of *G. vernicosa*, see its description above).

Paratypes. MADAGASCAR. **Antsiranana:** SAVA, 8 km après Andrakata, rte. Samsana-Andapa, *P. Morat 2788* (MO). **Toamasina:** Alaotra-Mangoro, Didy à Brickaville, *G. Cours 4927* (K, MO); Atsinanana, Ambinanindrano II, Ambalabe, Vatomandry, près de Vakona, S de Tobin'i Foara, 19°10′S, 48°35′E, *R. Ranaivojaona, R. Randrianasolo, A. Razanatsima, Velomahefa, Dada & Pierrot 959* (MO); forêt de Vohibe, NO de Toby Foara, 19°10′S 48°35′E, *A. Razanatsima, F. Rakotoarivony, L. Rasoaviety, Honoré & Céléstin 648* (MO, TAN).

42. Gaertnera xerophila C. M. Taylor, sp. nov. TYPE: Madagascar. Toamasina: Atsinanana, Brickaville, Firaisana, Andranonkoditra, Fokontany, Ankanin'ny nofy, forêt de Vohibola, 18°34′S, 49°15′E, 8 m, 4 Aug. 2003, *D. Rabehevitra, R. Razakamalala & J. Paul 410* (holotype, MO-5888585!; isotypes, P n. v., TAN n. v.). Figure 7F–I.

Haec species a *Gaertnera guillotii* Hochr. foliis latioribus domatiis carentibus atque limbo calycino longiore distinguitur.

Shrubs and small trees to 5 m tall, drying greenish brown to reddish brown; branchlets 3–5 mm diam., subquadrangular to subterete, glabrous. Leaves opposite; blades elliptic-oblong, 5.5–12 × 1.7–7.8 cm, drying subcoriaceous to coriaceous and matte, glabrous throughout, at base obtuse to rounded, at apex obtuse, rounded, or truncate and sometimes also with acuminate tips 1–3 mm; secondary veins 6 or 7 pairs, plane and not visible abaxially, without domatia, higher-order venation not visible abaxially; petioles 6–10 mm, glabrous; stipules calyptrate, glabrous, drying membranaceous and dark brown, caducous and sometimes fragmenting, 20–21 mm, smooth, with rounded wings 0.5–0.8 mm wide encircling undersides or all of petioles, at apex with 1 incision, narrowly triangular, ca. 2 mm, puberulous. Inflorescence cymose to congested cymose, many-flowered, terminal on principal branches, densely pilosulous to puberulous, sessile to pedunculate; peduncle 2–3 cm; branched portion corymbiform, 4–6.5 × 5–9 cm, branched to 3 or 4 orders; bracts narrowly elliptic to narrowly triangular, 3–8 mm, or sometimes those subtending basalmost secondary axes foliaceous; bracteoles triangular to narrowly elliptic, 1–3 mm, inserted below or often at base of or in lower portion of calyx limb. Flowers sessile to subsessile, biology unknown, 5-merous; calyx cupuliform, 2–3 mm wide, externally puberulous to glabrous, internally glabrous except puberulous to strigillose at base, tube 1.5–2.2 mm, denticulate to lobed, lobes or teeth 5, narrowly triangular to broadly triangular, 0.2–1.2 mm, a little unequal; corolla in bud obtuse to acute, at anthesis salverform, white, externally glabrous, internally densely barbate in throat, tube ca. 2.5 mm, slenderly funnelform, ca. 1 mm diam. near middle, lobes narrowly triangular, ca. 2.2 mm, at apex abaxially smooth, adaxially thickened to shortly hooked; anthers in presumed long-styled form ca. 1 mm, partially exserted; stigmas in presumed long-styled form ca. 1 mm, exserted. Immature drupes subglobose to ellipsoid and weakly flattened laterally, 4–5 × 5–6 mm; pyrenes 2, hemispherical, abaxially smooth.

Habitat, distribution, and phenology. *Gaertnera xerophila* is known from humid forest, often on sand substrates, at 0–700 m in eastern Madagascar in the province of Toamasina (Analanjirofo and Atsinanana). *Gaertnera xerophila* has been collected in flower in August and December and in fruit in February.

IUCN Red List category. *Gaertnera xerophila* is present in the protected area of Ambatovaky and the conservation site of Analalava. With a restricted geographic range size (EOO = 2318 km^2; AOO ca. 100 km^2), an expected continuing decline of the subpopulation at Vohibola, and only three locations, *G. xerophila* is here considered to be Endangered [EN B1ab(iii)+2ab(iii)].

Discussion. *Gaertnera xerophila* is known from humid vegetation but apparently at least sometimes is found in sites that are locally dry edaphically, and has very thick-textured leaves. These leaves differ from those of the other species of *Gaertnera* in their apparent adaptation for a dry environment; the species epithet refers this form. *Gaertnera xerophila* is similar in aspect and habitat to *G. guillotii*, which is found along nearly the entire east coast of Madagascar; *G. guillotii* differs in its smaller (1.7–13.2 × 0.7–4.6 cm), thinner-textured leaves with domatia, lack of or only tardy development of wings encircling the petioles, and shorter subtruncate calyx limbs 0.8–1.2 mm long (for contrasting characters of *G. xerophila*, see its description above). *Gaertnera xerophila* is also similar to *G. sclerophylla*, which is found in eastern and southeastern Madagascar; *G. sclerophylla* differs in its generally visible leaf venation, lack of or tardy development of petiole wings, shorter bracts, shorter subtruncate calyx limbs, and longer corollas with the tube 4–6 mm long and much longer than the lobes. The specimen *Rakotonoasolo et al. 682* was collected in wetter forest than the others and has somewhat smaller leaves and calyx limbs, but cannot be conclusively separated from the other specimens.

Paratypes. MADAGASCAR. **Toamasina:** Analanjirofo, Soanierana-Ivongo, Andapafito, Iampirano, Rés. Spéc. d'Ambatovaky, 4 km S of village, *F. Rakotonasolo, H. Beentje, H. Ralimanana & M. Rakotoarinivo 682* (K, MO); Atsinanana, Vohibola, forest N to NNW of village of Andranokoditra, N of Lac Ampitabe, 18°34′S, 49°15′E, *P. P. Lowry II, R. Rabevohitra, J. Rabenantoadro, R. Razakamalala & S. W. J. Lowry 6083* (K, MO, P, TAN); Brickaville, Ambinaninony, Andranokoditra, 18°33′S, 49°15′E, *J. Rabenantoandro, R. Razakamalala & J. Paul 872* (MO, P, TAN); Foulpointe, Analalava Forest Reserve, 17°43′S, 49°27′E, *J. Tosh, P. De Block & F. Rakotonasolo 89* (BR, MO, TAN).

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APPENDIX 1. Species of *Gaertnera* found in Madagascar and their conservation assessments using IUCN categories and criteria. See text for details of the conservation assessments.

G. alata Bremek. ex Malcomber & A. P. Davis, CR B2ab(iii)
G. arenaria Baker, LC
G. arenarioides C. M. Taylor, EN B1ab(iii)+2ab(iii)
G. bambusifolia Malcomber & A. P. Davis, LC
G. breviflora C. M. Taylor, VU B1ab(ii,iii,iv)+2ab(ii,iii,iv)
G. brevipedicellata Malcomber & A. P. Davis, VU B1ab(iii)-2ab(iii)
G. cardiocarpa Boivin ex Baill., EN B1ab(ii,iii,iv)+2ab(ii,iii,iv)
G. darcyana Malcomber & A. P. Davis, VU B1ab(iii)
G. drakeana Aug. DC., EN B1ab(ii,iii,iv)+2ab(ii,iii,iv)
G. furcellata (Baill. ex Vatke) Malcomber & A. P. Davis, EN B1ab(iii)+2ab(iii)
G. guillotii Hochr., LC
G. hirsuta C. M. Taylor, EN B1ab(iii)+2ab(iii)
G. hispida Aug. DC., VU B1ab(iii)+2ab(iii)
G. humblotii Drake, VU B1ab(iii)
G. ianthina Malcomber, LC
G. inflexa Boivin ex Baill., LC
G. laevis C. M. Taylor, VU B1ab(iii)+2ab(iii)
G. littoralis C. M. Taylor, EN B1ab(iii)+2ab(iii)
G. lowryi Malcomber, VU B1ab(iii)+2ab(iii)
G. macrobotrys Baker, LC
G. macrostipula Baker, LC
G. madagascariensis (Hook. f.) Malcomber & A. P. Davis, LC
G. malcomberiana C. M. Taylor, VU B1ab(iii)+2ab(iii)
G. masoalana C. M. Taylor, EN B1ab(iii)
G. microphylla Capuron ex Malcomber & A. P. Davis, EN B1ab(iii)+2ab(iii)
G. monstruosa Malcomber, VU B1ab(iii)
G. nitida C. M. Taylor, NT
G. obovata Baker, LC
G. obovata var. *obovata*, LC
G. obovata var. *sphaerocarpa* (Baker) Malcomber, LC
G. pauciflora Malcomber & A. P. Davis, NT
G. phanerophlebia Baker, LC
G. phyllosepala Baker, LC
G. phyllostachya Baker, LC
G. rakotovaoana C. M. Taylor, CR A3c
G. raphaelii Malcomber, LC
G. razakamalalana C. M. Taylor, EN B1ab(iii)+2ab(iii)
G. robusta C. M. Taylor, VU B2ab(iii)
G. rubra C. M. Taylor, VU B1ab(iii)
G. schatzii Malcomber, LC
G. sclerophylla C. M. Taylor, VU B1ab(iii)+2ab(iii)
G. velutina C. M. Taylor, VU B1ab(iii)+2ab(iii)
G. vernicosa C. M. Taylor, VU B1ab(iii)
G. xerophila C. M. Taylor, EN B1ab(iii)+2ab(iii)